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Electrical World

The consolidation of Electrical World, Electrical Engineer and American Electrician

Vol. 93, No. 15 **April 13, 1929** *Pages 719-766*

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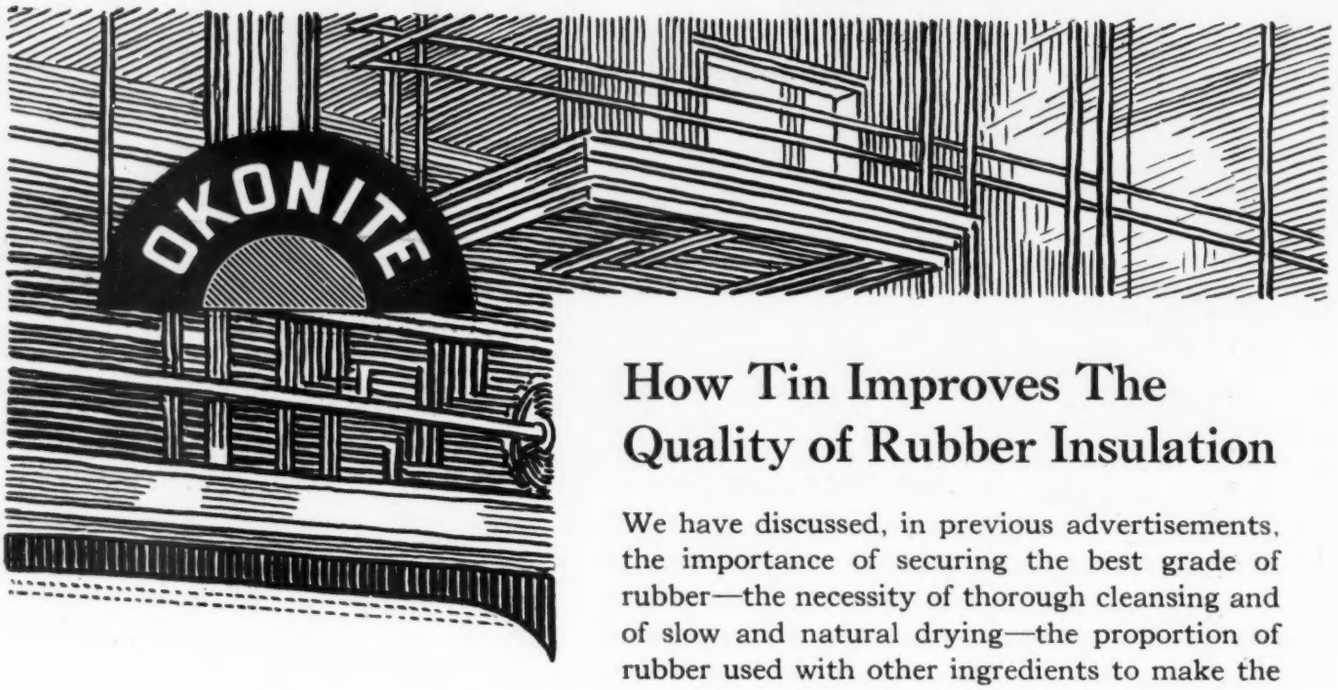
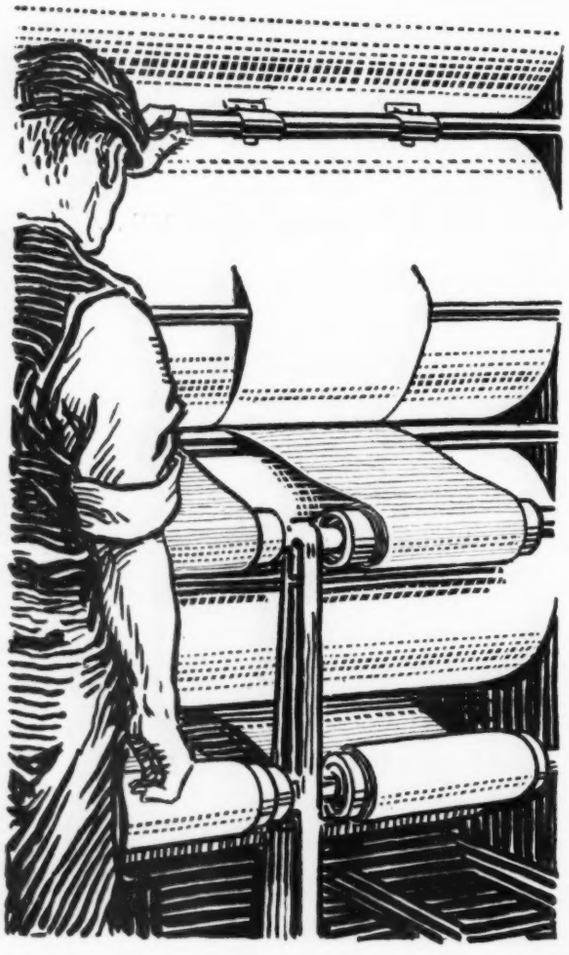
Statistics Fifteen Months Early

SEVEN days after the close of 1927 the ELECTRICAL WORLD published data on the operation of the light and power industry during that year. Fifteen months after the close of 1927 census data became available to the industry. A comparison of the data shown in the accompanying table is interesting.

Granted that some estimates were made in ELECTRICAL WORLD figures, there is a degree of accuracy as compared to census data that is of the same order of magnitude as the exactitude of either set of data. The census should be and is accurate and time must be taken to survey in detail. ELECTRICAL WORLD tries to give data promptly. That it does its job is evident.

	ELECTRICAL WORLD	U.S. Census
Horsepower of prime movers	35,500,000	35,622,593
Number of customers	21,694,100	21,732,080
Kilowatts of generating capacity	25,300,000	25,802,530
Number of establishments	4,409	4,327
Number of plants	4,147	4,387





How Tin Improves The Quality of Rubber Insulation

We have discussed, in previous advertisements, the importance of securing the best grade of rubber—the necessity of thorough cleansing and of slow and natural drying—the proportion of rubber used with other ingredients to make the insulating compound, and the way we grind and mix these ingredients to assure the durability and toughness of the finished product. Now comes a simple yet a vitally important process. We warm the "rested" compound and run it through a calender which forms it into sheets of the required thickness for each insulating wall. These sheets, in turn, are backed with sheets of *tin* which are *essential* to the exclusive Okonite method of applying insulation to the conductor and in the final process of vulcanization. Our following advertisements will describe these final processes, showing how each step in manufacture contributes to the unduplicated quality of all Insulated Wires and Cables made under the Okonite brand.

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IMPREGNATED PAPER CABLES SUPER-TENSION CABLES SPLICING MATERIALS

Electrical World

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Discount the Business Pessimists

THE first quarter of 1929 has witnessed splendid business conditions in this country. The electrical industry has participated in this activity, with generation in January and February 13 and 12 per cent respectively greater than in the corresponding months of 1928. Gross revenues have increased correspondingly and net earnings at an equal or greater rate. Economies in operation and improvements in production are being carcried out to make it possible to predict that utility earnings will be greater than for many years.

Annual statements of utility operations during 1928 are available in many instances, and the encouraging feature is that the net earnings increased 12 per cent as compared to a 7.9 per cent increase in gross revenue. Managerial efficiency is proved by these figures, because they show that it has been possible to reduce rates to give more and cheaper service and yet increase the earnings. The first quarter of 1929 shows even better records.

During the first quarter the utilities did public financing to the amount of $416,180,500 at an average rate slightly greater than 5.5 per cent. About 65 per cent of this financing represented new capital, and this fact indicates that plant facilities are being augmented to meet the increased demands for service. These expenditures should help maintain good business for electrical manufacturers and other producers of equipment used in the industry. Data on appliance sales show that customers are buying in great volume, and this is an indicator of widespread prosperity among consumers.

If all industries develop their business as conservatively and safely as the utility industry is doing, there is little doubt that present prosperous business conditions will continue indefinitely. The stock market should be studied, and agitation about speculative securities should be viewed in the light of the very sound business position of American industry. If this be done, many who are in an anxious state of mind will be reassured.

* * * *

A Business Reason for Well-Paid Labor

CHAMBERS of commerce and electric utilities that are trying to attract new industries to their territory often emphasize the availability of low-priced labor. This is an attractive factor to any industry in which labor constitutes a large percentage of production cost. But the question arises whether it is wise, even from any purely business viewpoint, to attempt to maintain or to stress the existence of such a labor condition. Low taxes are often more decisive than the cost of labor, and the quality of labor is of more importance than its price.

It is not sufficient merely to produce goods economically. A market must be developed, and its expansion depends on the prosperity of the working class, because the workers include the majority of individual purchasers, on whom bulk purchases depend. One need only start to trace the circulation of money from the workingman's pocket to see how many other persons benefit from its changing hands, or consider what would happen to industry and to commercial centers if the physical needs of the worker were eliminated. While civilization needs the capitalist to plan, finance and organize, it needs the workingman for equally important purposes, to perform the detailed duties of industry most efficiently and to create the demand for products made.

Well-paid workmen expand the market for products and consequently are essential to a prosperous community and a prosperous country. The electrical industry in particular should recognize this principle, for its success depends to an unusual degree upon a prosperous community.

* * * *

Coming Changes in Power-Company Sales Policy

TWENTY-FIVE years' experience has seen many changes in power-company sales policy. This is natural enough because almost the entire evolution of central-station commercial practice has taken place within that period. There have been radical revisions of principle, particularly in the domestic field.

First it was considered good policy to give small heating appliances away or sell them below cost in order to build more load. Not so long after interest centered on the larger labor-saving equipment that had minor load value but offered a good margin of retail profit which would help make sales departments self-supporting. And then, more recently, the industry has been enthusiastically campaigning to build up merchandising volume, often forcing sales with high-pressure inducements of fantastic terms or extravagant premiums.

The inevitable reaction is now setting in. Widespread criticism by other merchants and the obvious fact that, after all, the prime objective is to develop the consumption of electricity are influences toward more serious planning of sales to increase the kind of load that the system needs. It is interesting to consider, however, that throughout these twenty-five years men have ever felt that the commercial policy of the day was right. Which prompts the questions: Are we really sure that the present policy is right? How do we know? What has been done to prove it?

Two companies at least have recently decided to face these questions. They have been looking into the future and asking themselves who will be selling electrical equipment—domestic, commercial, industrial and agri-

cultural—ten and twenty years from now. They know that some day the farmer, the manufacturer, the merchant and the householder will be buying and using far more electrical appliances than they do today, and they have been wondering if the best possible distributing, retailing and servicing machinery is going to be ready and functioning as that day approaches. Should it be planned and guided or can it be left to grow of itself? Must the power company assume the responsibility to do the added selling or to encourage the expansion of a growing independent trade—and why and how? There is only one way to find the answer and that is by the most careful survey and analysis. Such studies are being undertaken by these two companies.

Public dependence upon electricity ten years from now will be far greater than today. It will require an ample and efficient trade to distribute this diversity of merchandise. What part will the contractor play in it—the hardware and department store, the specialty dealer, or the sales department of the light and power company? Who knows?

* * * *

Auxiliaries for Steam Plants Debated

SO IMPORTANT to dependable station operation is the problem of providing the most reliable power supply to steam-plant auxiliary motors that it cannot be discussed too often or too thoroughly. In a recent description in the ELECTRICAL WORLD of a prominent new steam plant mention was made of the fact that dependence for power supply to the auxiliaries is placed exclusively on the high-tension lines, because when the lines are down the particular steam plant is of no use anyhow. While this may be true, it must be remembered that after a line breaks down it is ready for service again the moment the repairs are completed, whereas it would take a considerable length of time after that to place boilers and turbines back into service.

The shaft generator has recently become very popular, particularly with high-pressure units. It offers the great advantage of not having any electrical connection whatever between the main power system and the auxiliary system, thus making the auxiliaries entirely independent of line disturbances or other system disturbances, since the only outside disturbance which might affect the shaft generator is a possible slowing down of the main unit—a very rare occurrence indeed. It has the further great advantage of making the rupturing capacity of the oil circuit breakers for auxiliary service comparatively low, thus simplifying the very elaborate and important auxiliary switching system, saving a great amount of space and reducing the cost. The shaft generator, on the other hand, with its very small exciter, which likewise must be accommodated on the shaft of the main unit, has the disadvantages, first, of being somewhat like a fly on the back of a mule and, second, of making the main shaft longer, thus requiring some extra length in the turbine room and unbalancing the load on the main shaft.

Another method which has received considerable attention recently is that of the tap transformer, consisting of a station auxiliary transformer connected directly to the generator without establishing a generator bus. This method will in many cases not require breakers of higher rupturing capacity than does the shaft generator scheme, and it eliminates the shaft extension of the main unit. However, space must be provided for the transformers, and the auxiliaries are subject to influence from line disturbances, particularly voltage drops. On the other hand, station auxiliary motors are now virtually all for across-the-line starting and do not trip out by occasional voltage dips.

Both the shaft generator and the tap transformer should be subjected to further discussion. With the many high-pressure plants now going into service, it should soon be possible to obtain reliable operating data which will bring out the advantages and disadvantages of both the methods and greatly assist in crystallizing the problem.

* * * *

Residential Check-ups Are Useful in Appraising Rates

RESIDENTIAL business is becoming so important in well-rounded power-company development that more systematic surveys of the use of service by home customers are highly desirable. There are two major approaches to an adequate analysis of residential service—(1) a study of meter readings, bills and total community appliance sales, and (2) a cross-sectional detailed inquiry into the electrical activities of a representative number of homes, to be applied to a given total area by an appropriate multiplying factor. Both of these methods are important in seeking the major causes of increasing consumption of energy per customer per year.

Interest in the results of applying promotional rates to residential service is now widespread. Progressive executives desire to determine if possible the effect of such rates over a selected period. The problem is complicated by other factors bearing upon the use of electricity in the home, such as the increased use of lighting and of "socket-power" radio sets, the transfer of various routine household tasks from human hands to appliances, and the introduction of heavy-duty devices for cooking, refrigeration, oil-burner operation, water heating and ironing. The analysis resolves itself into a series of eliminations in so far as attempts to fix responsibility for marked changes in the usage curve are concerned. Here the cross-sectional study is of great value, since it enables a fairly complete history to be outlined of the influence of adding particular devices or of the effect of rate changes upon an approximately fixed connected lighting and appliance load.

At the present stage of residential service development it is necessary to be content with approximations in evaluating the effect of particular factors upon the use of electricity in the home. A moment's thought shows that in a given household equipped with several heavy-duty devices the causes of variations in monthly consumption of energy are anything but few and simple. The group study takes advantage of psychological diversities which create the family index of usage and provides a sort of common denominator by which striking variants may be left exposed to the keen investigator. There is here a problem comparable in intricacy to not a few scientific researches, and many resources must be utilized in order to arrive at the effect of a single variable such as a rate change upon usage. The time is fast approaching when analytical subdivided temporary metering of residential usage will become much more widely applied—this has little to do with the revenue metering—and appropriations for this class of survey work will be approved on

a far greater scale than in the past. The electrical "family" itself offers a first-class proving group for much preliminary work of this kind, especially in pioneering devices, prior to their general offering to the public on rate schedules seasoned by being based on field data.

* * * *

Tie Lines Keep Plant Investments at Minimum

AN INTERESTING case of tie-line effectiveness appears in a reprint of the latest annual report of the Public Service Corporation of New Jersey. During 1928 the company's total generating-plant capacity decreased by 12,556 kva. net as the result of discontinuing four inadequate and obsolete plants aggregating 35,950 kva. and the rebuilding of certain units at Kearny and Essex adding 23,394 kva. to the productive capacity of the system. The company generated 11 per cent more energy than in 1927, and its total plant ratings at the end of 1928 aggregated 611,876 kva. These plants produced more than twelve times as much energy as the company purchased. The peak load increased from 435,500 kw. to 480,500 kw. During the year the company's transmission ring system was strengthened, and it is significant that with an actual decrease in generating capacity much larger loads were handled than in the previous year. The generated output reached 1,736,606,653 kw.-hr.

The conclusion is inescapable that interconnections of plants owned and operated by the company played a vital part in furnishing the immense volume of service required and that without such interconnections plant ratings would have been heavily increased. Of course, this does not prove that tie lines *per se* between generating stations represent the best engineering solution of a particular power supply problem over a stated area, for, to assure a sound decision, the choice between lines and plant expansion must be worked out for every individual case. None the less, the foregoing figures testify as to the competence of both intercompany and, especially, company interstation ties in forcing the dollar invested in productive steam and electrical equipment to work harder and more effectively than if no regional transmission had been planned, built and skillfully operated.

* * * *

Why Not Rate Lamps and Appliances at Different Voltages?

VOLTAGE regulation for domestic service is becoming an acute economic problem. In a transition stage from 500 kw.-hr. per year to 5,000 kw.-hr. per year per customer—a goal now sought by the industry—it is very difficult to maintain good voltage regulation. When ranges and water heaters, for example, are not in operation, the voltage is apt to be too high for lamps. On the other hand, when the range comes on it is necessary to have the heating elements attain temperature quickly to give good cooking service. A range demand during the day of 0.5 kw. to 5 kw. puts a big handicap on good voltage regulation.

Distribution systems will have increased copper capacity as saturation occurs, but there is an economic limit to this development during the transition stage. Moreover, it is well known that house wiring is inadequate for the heavy loads, and no cheap methods exist for remedying this situation. It becomes necessary, therefore, to study ways and means of giving augmented domestic service at a reasonable cost.

An economical procedure during this transition period would be to admit of a stepped voltage condition. Lamps, for example, might well be based on 120-volt operation while heavy-demand appliances can be rated at 110 or 115 volts. With this arrangement, at light load the lamps would operate at the most economical point and at heavy load, since they would be on interior branch lighting circuits, they would not operate at such a low voltage as to affect the lighting service noticeably. On the other hand, the heavy-duty appliances that operate chiefly in the daylight hours would have their heating units adjusted to meet the decreased voltage that would occur at the heavy demand.

The basis of approach to this problem is the maximum over-all industry economy to give augmented domestic service, and during the transition stage there is no inherent merit in 100 per cent voltage regulation— the cost is prohibitive. It would be well, therefore, to study the possibilities of rating lamps and appliances at different voltages so as to meet the actual voltage conditions encountered at service outlets.

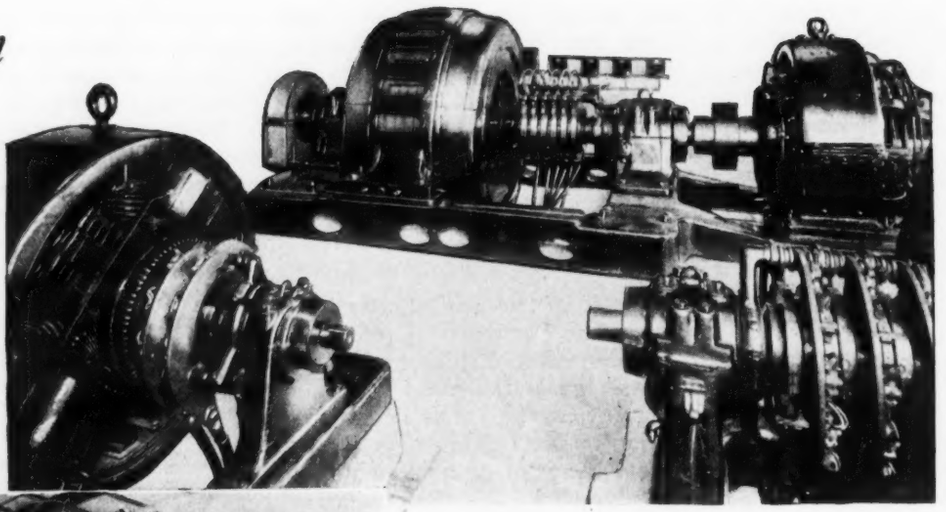
* * * *

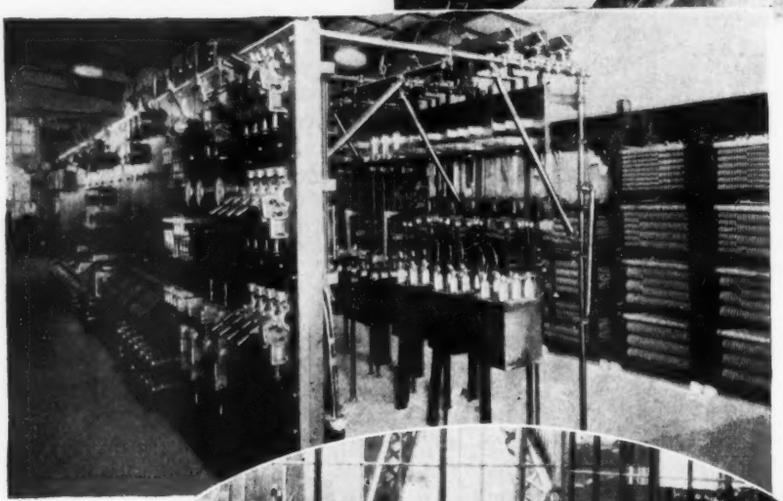
Luxury Sometimes Comes Before Costs

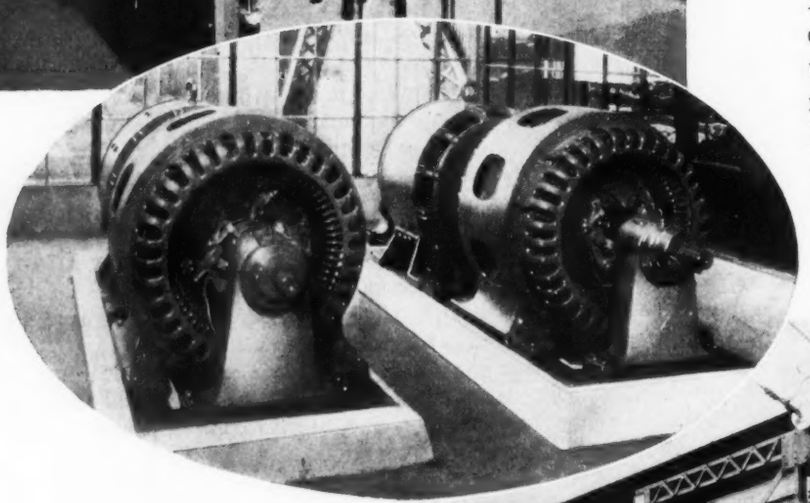
EARNEST endeavor to reduce the cost of electrical energy to the ultimate consumer has, in a measure, led utility men and the public served to regard electric service as a necessity which should be made available to as many potential users as possible for the economical, speedy accomplishment of difficult and tedious tasks. This indeed is desirable, but electricity may be a luxury as well as a necessity, and to overlook the viewpoint of luxury service is in some instances to fail to carry through to proper utilization. At the rates commonly prevailing for moderately large consumers of power, electric heat cannot often compete on a B.t.u. basis with gas or coal, even though heat conservation be rigorously observed. Of course, recuperative and continuous processes may be used where discontinuous and intermittent heat applications may be considered too costly. As a necessity electric heat may be too expensive; as a luxury it may be well justified.

Some manufacturers of high-grade metallurgical materials have found it to be well worth while to indulge in an apparent luxury in order to secure the uniformity, homogeneity and assured quality which perfectly controllable, constant-atmosphere electric heat permits. One company, to which is credited the use of the first electric induction furnace, has been unable to adopt further electrification on an economic basis but has continually extended it on the quality basis. There is, it often appears, too much consideration for costs and too little consideration for results. Old adages have gone flying before the new era, but the best is still sometimes worth having just because it is the best; for some one, with high disregard for costs, is likely to pay for the better things. There will perhaps always be Fords and Rolls-Royces, "movies" and opera, Avenue A and the Champs Elysées, Woolworth and Tiffany, the things that many can afford and the things reserved for the few. Electricity can serve them all.

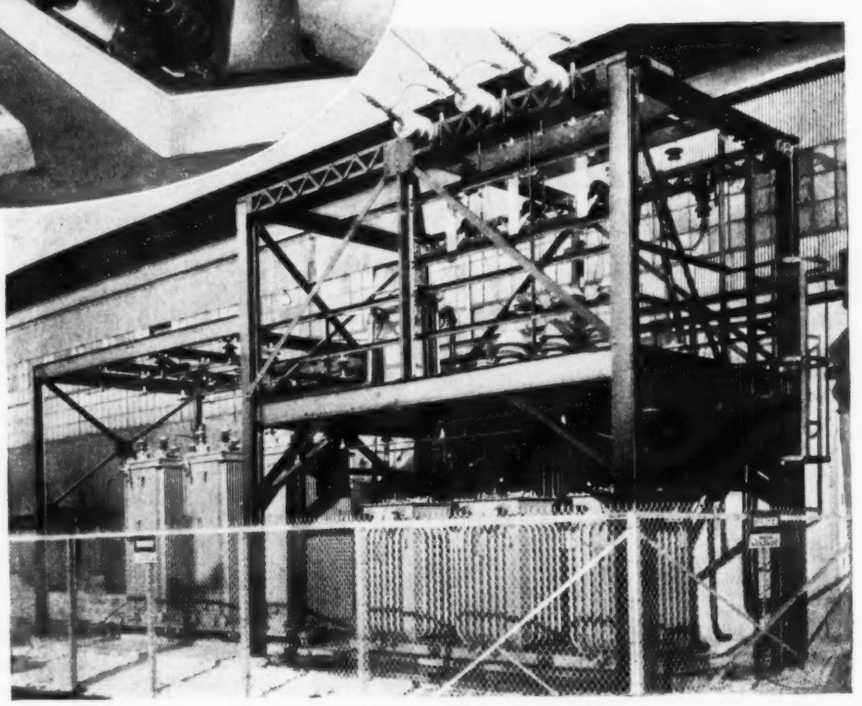
Electrification of Rerolling Mill







ELECTRIC energy from the system of the Columbus, Delaware & Marion Electric Company has recently displaced direct steam drive in the rerolling mill of the Pollak Steel Company at Marion, Ohio. Considerable operating economies are anticipated. The Freyn Engineering Company, Chicago, Ill., acted as designer.

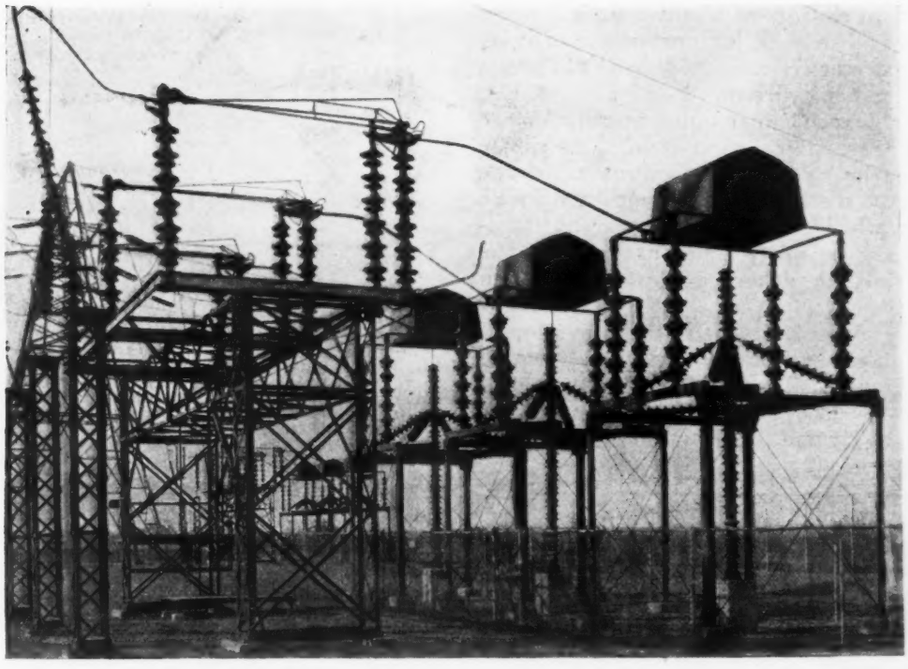


Top—One of the two Kramer mill drives. This unit has a 1,200-hp. a.c. and a 335-hp. d.c. motor on one shaft and a 1,200-hp. converter, which is shown in the foreground. The other Kramer set has an 800-hp. a.c. motor and a 240-hp. d.c. with an 800-hp. converter.

Center— Main control switchboard with Kramer set resistors along back wall.

In Oval—The two 200-kw. motor-generators that furnish direct current in the mill.

Bottom—Service entrance at 13.2-kv. and 750-kva. and 2,500-kva. transformer banks.



25-kv. autovalve arrester (modified form)

Arrester Aims and Prospects

Lightning protection problem analyzed. American and European approaches outlined. Lessons from oscillograms and experience. Some modifications and new applications suggested

By A. L. ATHERTON

Arrester Engineer Westinghouse Electric & Manufacturing Company

ANALYSES of system operation have shown clearly that on an unprotected system or portion of a system lightning voltages are the predominant cause of interruptions. Proper application of arresters now available will reduce the average number of lightning failures from approximately 7 per cent, which we might anticipate without protection, to one-tenth this value, or under favorable conditions possibly to one-twentieth. Fortunately, Dufour oscillograms show the operating characteristics of lightning arresters in sufficient detail to indicate the deficiencies which limit the protective value and thus to point the way to further improvement.

Recently some doubt has been thrown on the introduction of dangerous voltages through the release of bound charges, the thought being that cloud discharge will be slow enough to permit induced energy to dissipate at a sufficiently rapid rate to prevent the accumulation of dangerous voltages. If this belief is true precautions have to be taken only to prevent direct strokes terminating in the line.

The traveling wave or surge which results when surge energy moves along a circuit is the phenomenon with which lightning protection has to deal. In an unprotected system the wave travels along the circuit until it flashes over some insulator, establishing a ground connection, and is reflected back along the circuit with reversed polarity and with a magnitude reduced by whatever energy is lost in the flashover or until an end of the circuit is reached, where a reflection takes place and the wave returns along the circuit without polarity reversal and with substantially unreduced magnitude. At a branch in the circuit the energy divides between the two paths in accordance with the surge impedances. For equal surge impedances the voltages are equal to two-thirds of the voltage ahead of the branch. At a branch where the surge impedance is ap-

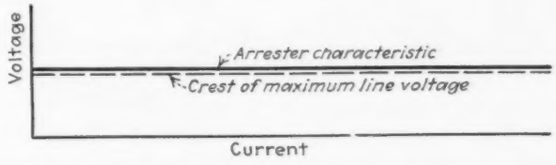


Fig. 1—Early American ideal arrester permits no rise in voltage above the crest value of maximum line voltage

When a surge voltage is applied no current flows in the arrester until the voltage value of the characteristic is reached. Current then starts and rises as the applied voltage is increased, the value always being just sufficient to maintain the arrester voltage constant. When the applied voltage reaches its crest and begins to decrease the arrester current decreases and the voltage on the arrester terminals remains constant. The current becomes zero when the applied voltage has decreased to the voltage value of the arrester characteristic.

proximately one-tenth that of the supply line the voltage is reduced to approximately 17 per cent of the arriving transient and the current reflected back over the line is 83 per cent of the arriving current.

The length of a branch circuit must be sufficient to contain the entire wave if the effect is to be as simple as described. The lower the surge impedance of the branch conductor the more will the voltage be reduced. Since the voltages which are liable to appear on transmission circuits may be many times as great as the strength of the insulation, a large percentage reduction must be brought about.

Consequently the American aim has been to connect protective devices in place of branch circuits and provide as low surge impedance as practicable. This has led to the conception that an ideal lightning arrester would be one which permits no current to flow up to the maximum

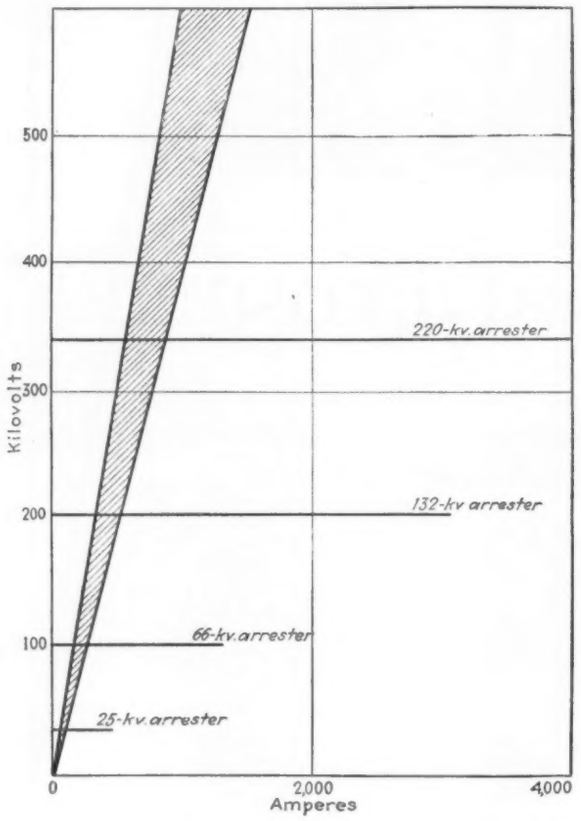


Fig. 2—Comparison of European and American arrester performance

The shaded sloped area represents the range of European characteristics, based on surge impedances from 400 to 600 ohms. The horizontal lines represent the idealized American arresters for the line voltages indicated.

line voltage, but beyond this value permits any current required to hold the voltage down to the same maximum line voltage. Such a device would reflect merely the transient, slightly reduced by internal losses. The resulting successive application of voltage with extremely small time intervals will result in progressive breakdown or flashover effects, much more serious than those caused by a single application of the same voltage.

European engineers have aimed to absorb the energy of the transient and have more or less ignored local control of the voltage.

Both aims cannot be correct. Some consideration has led to the belief that a combination of the two functions

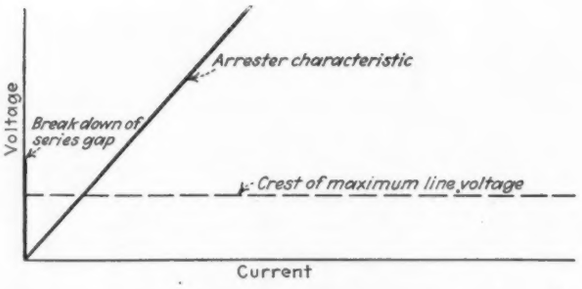


Fig. 3—Ideal European arrester absorbs surge energy

After current is established by the break-down of the series gap the voltage across the arrester is proportional to the current and the impedance equals the surge impedance of the line. In such an arrester current due to line voltage will flow following an operation and the means must be provided to interrupt this current.

of voltage reduction and energy absorption will provide the ideal aim. If we can proportion the protective device to consume as much of the energy of the transient as is consistent with local protection we will have the optimum condition. At first it appears that the only wholly safe arrester, particularly for apparatus the insulation of which may have deteriorated to some extent, would have the characteristics shown in Fig. 1. Whether this is true or not depends entirely on the characteristics of the insulation.

Allowable Voltage Margin

Surge punctures are invariably free from any signs of burning, unless they are followed by current due to line voltage. In general, the voltages which may be applied for any short periods of time without any indication of damage are very much higher than the insulation will withstand for long periods of time.

Thus, it is not a safe procedure to assume the minimum safe margin over line voltage. There may be no real benefit to local protection in reducing transient voltages to very low values, and there certainly is a disadvantage from the standpoint of energy absorption in any reduction below that necessary for good local protection.

According to laboratory tests using surge voltages having a wide range of magnitude and duration, a variety of insulating materials and laboratory forms of protective devices (Fig. 4), damage to insulation begins at approximately 2.5 times the line voltage. This takes into account the factors of safety normally used in design for 60-cycle apparatus.

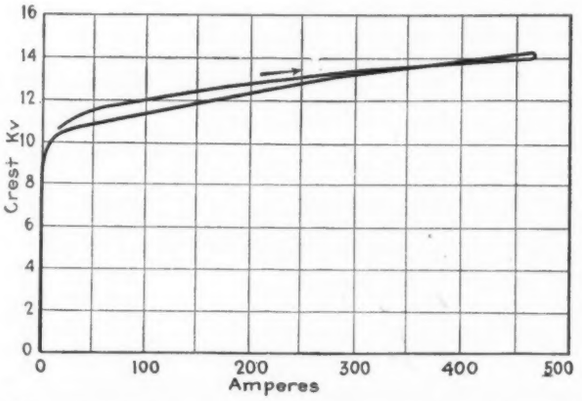
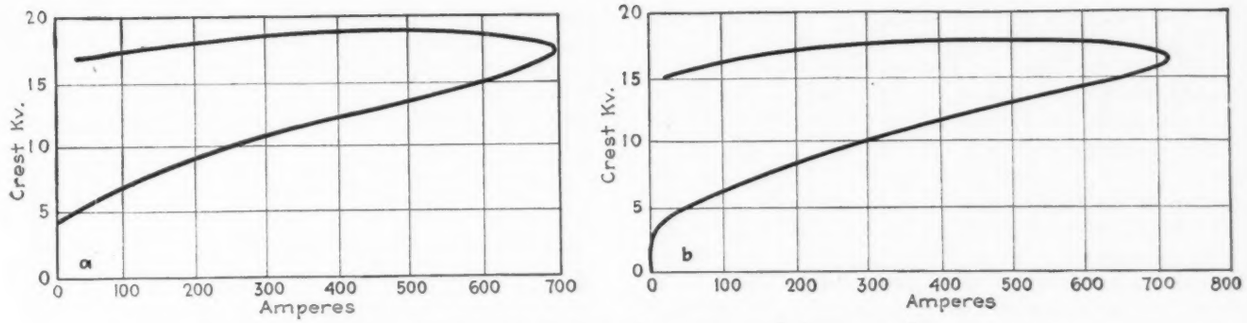


Fig. 4—Characteristic of an experimental arrester approaching the ideal (Fig. 1)



Figs. 5a and b—Characteristics of commercial autovalve arresters with and without normal series gap

Arresters show entirely continuous performance when the series gap is not used, indicating that there is no evidence of overshooting of the applied voltage beyond the normal characteristic of the arrester. When a series gap is introduced the voltage overshoots and is followed by oscillations. To make a theoretical determination of the efficacy of such arresters it would be necessary to evaluate the effect of these extremely brief overvoltages.

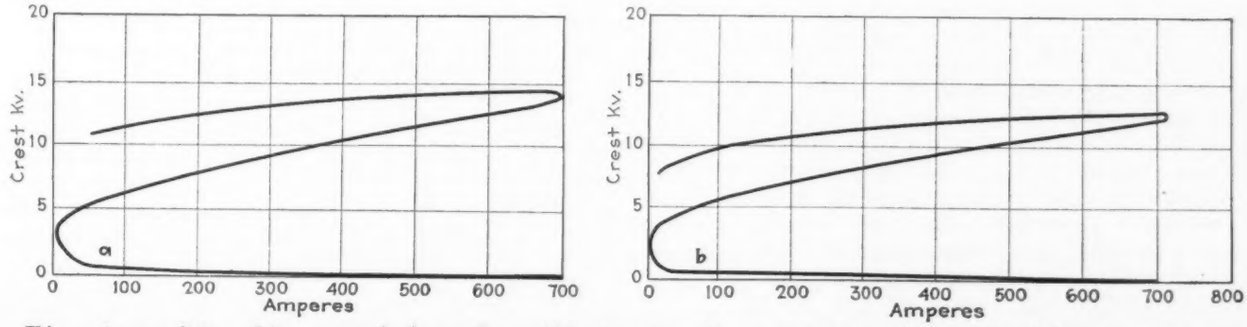
Field Observations

Arresters represented by Figs. 5 and 6 are forms which have had rather widespread commercial use and with which protection results have been closely observed. In locations where an opportunity has been available for several years to observe lightning damage with circuits unprotected and also with the first kind of protection something like 90 per cent of the lightning damage was removed by this kind of arrester. After a few thousand arrester-years' service experience with the second type and a maximum of three years of records no case of apparatus damage is recorded. Both of these service records have been made with average transformer installations, including old and new transformers, and with various relations between transformer rating and line insulation, so that the range of conditions is wide.

These findings support the laboratory indication that it is not necessary to reduce the transient voltage to less than 2.5 times the arrester rating to secure sufficiently good local protection. On the basis of this information, it is reasonable to consider the ideal toward which we may aim to be an arrester with a characteristic shown in Fig. 7.

With such an arrester adequate local protection will be secured, the maximum amount of energy absorbed being consistent with full local protection during both the rising and falling parts of the transient. A further advantage of this kind of arrester is in the greatly increased freedom from troubles with the arrester itself. Fully 95 per cent of the failures of the present commercial forms of arresters are due to overvoltage maintained longer than the arrester will withstand. Obviously, the raising of the cutoff voltage from practically line voltage to 2.5 times this value will remove substantially all of these cases of trouble.

Three-phase autovalve arrester for 66-kv. service



Figs. 6a and b—Characteristics of modified autovalve arresters with and without series gap

The fact referred to above that arresters now available perform possibly 90 per cent of the protective function indicates the need for further development. Further reduction in cost would also be a definite benefit.

Considerations which have led to the determination of the ideal characteristics as a constant line for the entire duration of the transient point the way to improve the performance characteristics. The present characteristic curves should be reduced on the rising portion from 3.5 to approximately 2.5 times the maximum line voltage. The returning portion of the curve should change from its present slope to a constant value involving a decrease at the beginning and an increase at the end of the return curves.

The cathode dark space of glow discharges possesses just the performance characteristics required for the ideal arrester. Considering the performance of arresters which use this principle (Fig. 5) it will be noted that the major deviation from the ideal horizontal characteristic lies in the loop between the rising and descending portions of the characteristic curve. This is introduced by the fact that the actual spacing between electrodes is nearly fifteen times as great as the optimum spacing. If we could produce an arrester exactly like the present autovalve arrester, but with a perfect spacing, we might anticipate a performance characteristic such as shown in Fig. 9, in which the only deviation from the desired characteristic lies in the resistance of the electrodes.

An approach to this condition has been secured in perfectly feasible experimental arresters by so making the disk electrodes as to permit their use in direct contact instead of spaced by mica rings. In such a construction each gap becomes the casual separation determined by the deviation from planeness of the electrode surfaces. The heat of the leakage current which will follow an operation of the arrester is concentrated at the very small contact areas and raises the resistance of these points until the heating effect is practically eliminated. After this the leakage current is reduced to a value which causes no more concern. To take care of the leakage

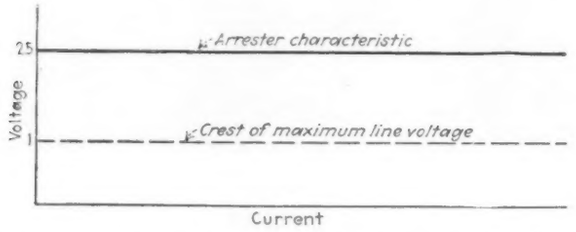


Fig. 7—Ideal arrester holds transient voltage to 2.5 times the arrester rating

current during the first few operations of the arrester it is necessary to provide a series of small gaps in place of a single larger gap. The performance characteristics of such an arrester are illustrated in Fig. 6.

One surprising thing about the results secured with this arrester is the improvement brought about by breaking up the single series gap into small parts. Two factors seem to have contributed to this improvement: First, the speed of a series gap is reduced as the sum of the separations of electrodes is reduced; second, complete inclosure of these gaps prevents surface corrosion very effectively and thus prevents the gradual slowing down of gap speed with time.

Several thousand such units have been placed in service in various parts of the country for various voltage ratings. No damage to any piece of apparatus protected with this type of arrester has been reported to date. The fact that this type of arrester permits a maximum voltage approximately 2.5 times the line voltage and still

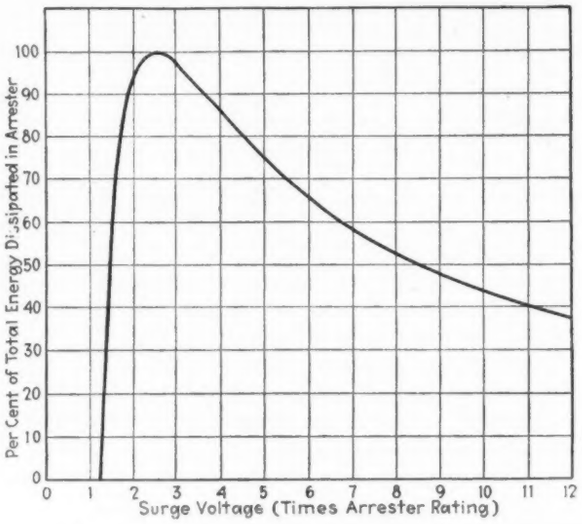


Fig. 8—Portion of surge energy consumed by arresters with characteristics of Fig. 7

affords substantially trouble-free service is strong evidence that no lower voltages are necessary for eliminating lightning damage. Plans are being carried out to complete the design so that this type of arrester should be available throughout the voltage range within the next year or two.

What remains to be done by way of improvement? Practically all arrester failures come from overvoltage, since all arrester designs are made with no real margin of safety in order to take best advantage of the performance characteristics available. Quite evidently a radical improvement could be effected by increasing the cutoff voltage. This could be done without decreasing protection, and with added absorption of surge energy, by still further closing the loop between the increasing and decreasing parts of the curve. Work is being done along these lines and some progress has been made, but nothing is available in commercial form yet.

Another line of thought which holds considerable promise is suggested by the analysis of results secured with the klydonograph.* On the basis of 2.5 times maximum line voltage as the dividing point, fully 50 per cent of all transient voltages which damage apparatus insulation and something like 90 per cent of the voltages which cause immediate failure of connected apparatus produce flashover on the line. Thus, lightning arresters installed in the station are available for protective purposes on only 10 per cent of the cases of maximum severity and only 50 per cent of all the cases of dangerous overvoltage. This suggests the thought that it might be possible to gain more from arresters by placing them along the circuit at sufficiently close intervals to provide paths to earth at or near the point where the surge voltage originates and consume the energy locally. This sort of protection would probably protect the terminal stations better than present station type arresters, par-

*"Klydonograph Surge Investigations," J. H. Cox, P. H. McAuley, L. G. Huggins, Transactions A.I.E.E., Vol. XLVI, pages 315-329. "Lightning Arrester Problems," A. L. Atherton, A.I.E.E.

ticularly where a considerable length of conductor within the station has to be protected by a single arrester.

The extent to which these benefits might be realized depends largely on how the disturbances originate. If direct strokes are involved, it is quite likely that the

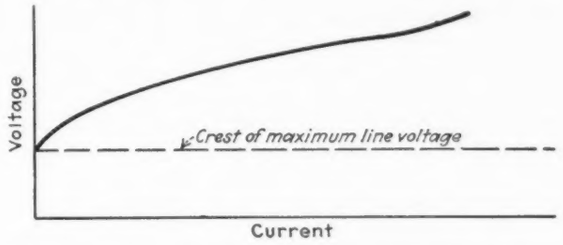


Fig. 9—Characteristic of autovalve arrester with ideal spacing of valve gaps

In such an arrester all departures from ideal characteristics are eliminated except those introduced by the inevitable resistance of the electrodes.

disturbance will be sufficiently intense to prevent any benefits from arresters. However, even in the case of direct strokes it is possible that the impedance of the cloud-to-line path is sufficiently great to limit the current to a value which can be handled by the arrester. On the other hand, if the disturbances are produced through the release of bound charges there is more chance that practically complete prevention of line insulator flashover can be secured. Even in this case the rate of voltage increase as the cloud charge is dissipated may be a controlling factor. In view of the fact that a cloud is composed of material having relatively small conductivity and because the distances within the cloud are considerable it seems likely that the process of cloud discharge takes some appreciable time, so that the energy on the line is released gradually. Under such conditions relatively wide separation of arresters would probably be effective.

One bit of evidence is significant. Along one line of considerable length so designed that the flashovers were frequent it was distinctly noticeable that 2 miles or so of circuit adjacent to each arrester appeared practically immune to flashover.

Although it may not be necessary to install arresters closer than several miles apart, the cost of arresters now available would be prohibitive and the space requirements might be a serious barrier. Moreover, the performance requirements are changed to some extent. The requirements for local protection would be determined not by solid insulation, but by the air path around an insulator string.

Some attention has recently been given to eliminating insulator flashover by providing some circuit-clearing devices such as fuses, etc., which open the power arc following a flashover before the station breaker is operated. The proposal to distribute lightning arresters along lines has the advantages of eliminating whatever maintenance is involved in such a scheme and of providing absorption of the surge energy so reflection of opposite-polarity surges would be prevented.

Arresters for this kind of use will have to be considerably smaller and less expensive than those now available. This is not beyond solution, however, because the size and cost of present-day autovalve arresters are determined by demand and not by material requirements. All that is necessary is to find ways to use the available materials to better advantage, and when this is done arresters of materially smaller size and thus presumably of less cost can be produced. The length of such an arrester must not exceed by any appreciable amount the length of the string of suspension insulator units to be protected. The weight is limited by the supporting structure.

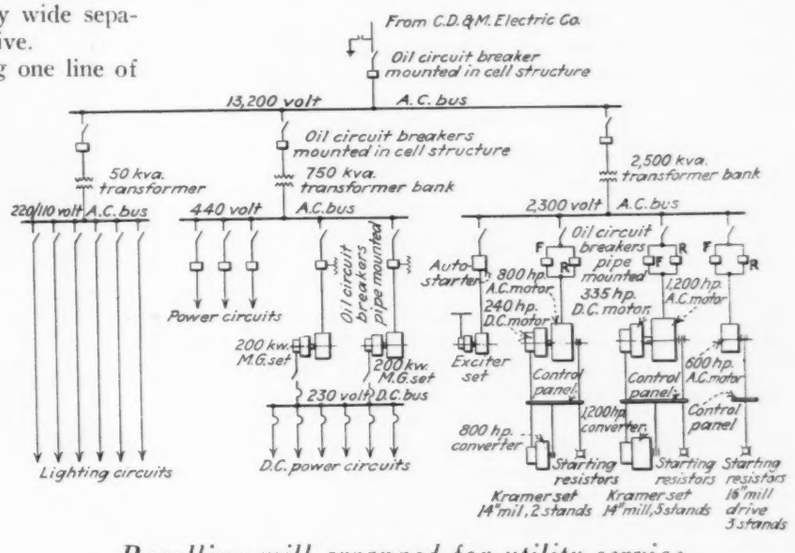
Some idea of the cost can be secured by considering the average distance between stations and the average spacing which may be permissible with such arresters, but it should be remembered that the resulting number of arrester units will be directly substituted for the station type arresters commonly used at the line terminals and that line arresters eliminate line insulator flashover to some extent.

This program, aiming toward a wholly different kind of arrester to be used in a wholly different way from the present practice, is in its earliest stages. It cannot be hoped that the building of arresters into line-insulator units will be accomplished for quite a few years at least. However, enough progress has been made to indicate that the scheme is not at all unfeasible.

Rail Rerolling Mill Electrified

By Arthur J. Whitcomb
Assistant Electrical Engineer Freyn Engineering Company Chicago, Ill.

THE Pollak Steel Company operates a rail rerolling mill at Marion, Ohio, producing standard and special bars, shapes, reinforcing bars and fence posts from worn rails. A study was made of the economies that might be obtained through the use of electric drive with



Rerolling mill arranged for utility service

purchased power as contrasted with the installation of new boilers if the direct steam drive were to be retained. It was at first determined that although some saving could be made, a highly attractive return could not be earned on the investment required for the electric drive. Under the usual power schedules, the load factor and load distribution incident to the rolling operations would not permit the earning of a satisfactory rate. Through analysis of the possibilities for compromise, coupled with

a spirit of co-operation between the utility and the steel plant management, an arrangement was finally perfected whereby the steel company adjusts its hours of operation to avoid superimposing its heavy demand on the peak of the utility company.

The power contract with the Columbus, Delaware & Marion Electric Company consists of the usual components, the demand or service charge and the energy charge. The service charge is split in two parts, an "off-peak" demand and an "on-peak" demand. "On-peak" hours are specified by the power company and do not exceed four per day. The demand charge for "on-peak" hours is twice that for "off-peak." The demand is taken as for a fifteen-minute period. The energy charge is uniformly low throughout the year for night use and for daytime use during the summer period. For daytime use between September 30 and April 1 a 30 per cent higher energy charge is made.

The extent of mill operation varies, but in no case does it exceed twenty hours per day. It was therefore deemed possible to regulate rolling operations to avoid the use of large amounts of power during the "on-peak" hours. Under this arrangement the cost of purchased power was reduced to a point which justified electrification of the mills and this course was finally determined upon.

The electrification layout is shown by the schematic diagram. It was possible to install the transformer station, the switchboard and the control equipment in advance. The change-over from engine drive was accomplished in two steps. In the first step one of the engines was removed and replaced by the 1,200-hp. motor. In the second step the other engine was removed and supplanted by the 800-hp. and 600-hp. motors. The mill was shut down a total of nine working days during the two change-overs. The electrification has proved very satisfactory. Maintenance costs have been reduced, notably due to elimination of the old boilers. The total operating saving due to electrification, as compared to the former steam drive, proves the value of purchased power.

Unit Cost System Simplifies Operating Budgets

By E. K. Albert
Northwestern Public Service Company, Huron, S. D.

THE Northwestern Public Service Company operates in a comparatively sparsely settled territory in South Dakota. It has a total of 1,100 miles of transmission line, ranging from 11 kv. to 33 kv., and serves approximately a hundred communities with a total of 28,500 consumers. Naturally with a property so spread out the problem of holding the transmission maintenance and expense and distribution maintenance and expense down to a reasonable percentage of the gross revenue is a very difficult one.

About five years ago this company started the practice of making up an operating budget for the following year, showing estimated revenues and expenses for each month in detail. In making up these budgets accounting department reports were referred to for previous years' operations. Due to the fact that the years for which records were available were years in which new towns were continually being added to the system and new transmission lines were being built, it was nearly impossible to use past figures as a basis for the following year's budget. To overcome this difficulty a plan of setting up unit costs was conceived. On transmission costs the cost per mile per month is used as a basis and on distribution the cost per consumer per month.

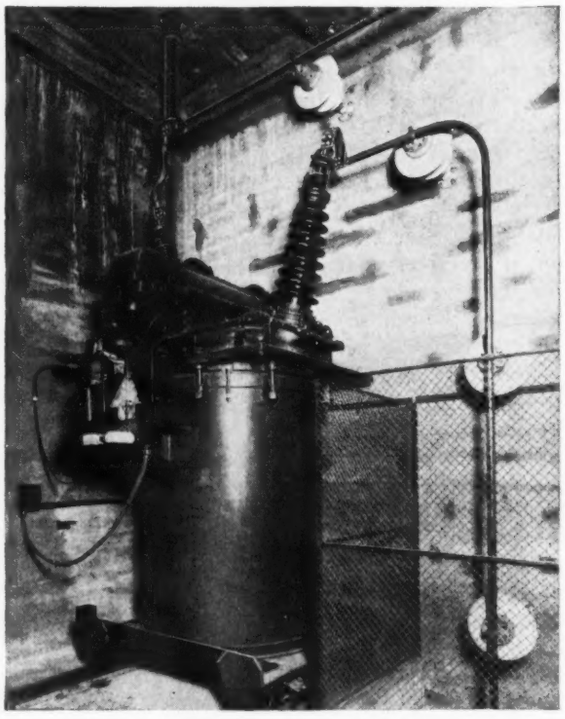
It has been found that this method gives a much better and fairer comparison for setting one district up against another. It has also been found that this system of comparing costs has stimulated the interest of distribution superintendents to a marked degree. By this increased interest it has been possible to check costs which were out of line and materially reduce costs in these departments. In addition to this, these unit costs have proved very useful to the new-business department. When the acquisition of a new town is being checked up, it simplifies matters greatly to have these unit costs to use in calculating the operating expense for this particular acquisition.

The average unit costs for 1928 are shown in the following table:

Substation expense and maintenance per mile per month	$0.58
Transmission line expense and maintenance per mile per month	2.17
Distribution expense and maintenance per consumer per month	0.22
Utilization expense and maintenance per consumer per month	0.07

Utilization includes maintenance and expense of street lighting equipment and expense of free service to consumers.

Provision for Breaker Maintenance



AN INTERESTING feature to be noted on the 66-kv. oil circuit breakers in the new Washington Park substation of the Commonwealth Edison Company, Chicago, is the use of flexible leads and separable connectors by which all connections, including the control and bushing current transformer circuits, can be quickly disconnected or joined. The oil in the breakers may be changed or sampled without opening the tanks through pipe connections which do not show in this picture. If for any reason a switch has to be taken from its place it is easily handled with a permanently installed trolley chain fall which runs the length of the gallery to a working space at one end.

Electrical Progress in Japan

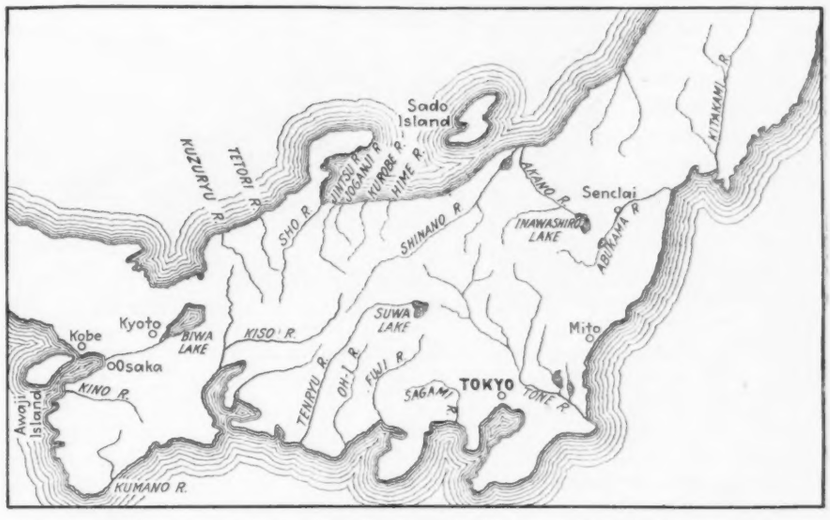
Co-ordination of electricity, coal and industry in Island Empire holds great future for Japanese people

By KING HAMILTON GRAYSON
Consulting Research Engineer

TWO THOUSAND factories per year average increase added to the power lines in Japan and still greater possibilities ahead have attested the growth of industry and the popularity of electricity over the hand-labor type of factory, of which there are still many in operation. This increase in power consumers has been steady and without any dropping off in consumption, regardless of unsettled financial or business conditions. Motive power developed by steam turbines and water turbines was almost on an equal basis in 1925, the former being 696,552 hp. and the latter 683,948 hp. Since that date, however, hydro-electricity has taken the lead, due in a measure to the ever-increasing wage scales and the costs of fuel.

While the first hydro-electric plant in Japan was started in 1891 through the building of a canal from Lake Biwa to Kyoto, the true awakening to the value of this form of power did not come until 1907, when the success of the Tokyo Electric Company in transmitting 55,000 volts from Yamanashi to Tokyo caused public attention to be focused on the industry. The lines of the Tokyo company covered a distance of some 50 miles and as soon as the power was available numerous industries began to clamor for connections. This led to the construction of a second line by the Inawashiro Hydro-Electric Company in 1914, covering a distance of 150 miles at a transmission voltage of 115,000. From that moment it appeared that industry, railways and the public all combined to encourage the development of electricity generated through water power, until today it has become the backbone of the still greater plan for an industrialized Japan. This industrial expansion is best illustrated by the figures of 1922, when there were 33,660 factories operated by electric power; by those of 1925, when the total reached 38,221, and by those of 1928, with an increase to 43,318 plants drawing on the power lines of the infant industry, "white coal."

Industry, transportation, mining and various governmental departments are all vitally interested in the sum total of electrical development, because Japan's foremost subject for consideration is industrial employment—ever-increasing industrial employment through more kinds and sizes of factories. The advance of the textile industry is due to the advance of the electrical industry; the development of the chemical plants is a direct result of the electrical expansion, and the electrification of the railroads is made possible through the hydro-electrification of Japan. Hand looms in the textile mills are being rapidly replaced by power looms and small looms are being supplanted by still larger ones. In 1924 there were 260,222 power looms in the mills and 348,206 hand looms. In the year 1925 there were 368,201 power looms; those operated by hand had dropped to 303,784.



Principal hydro-electric rivers in middle Japan

The following table gives an idea of the development of hydro-electric power and of the river surveys, showing available water power:

Electric plants in operation at end of 1926.....	5,410
Developed water power, kilowatts.....	1,902,000
Developed steam power, kilowatts.....	1,021,000
Total developed power, kilowatts.....	2,923,000
Under construction, kilowatts.....	1,642,000

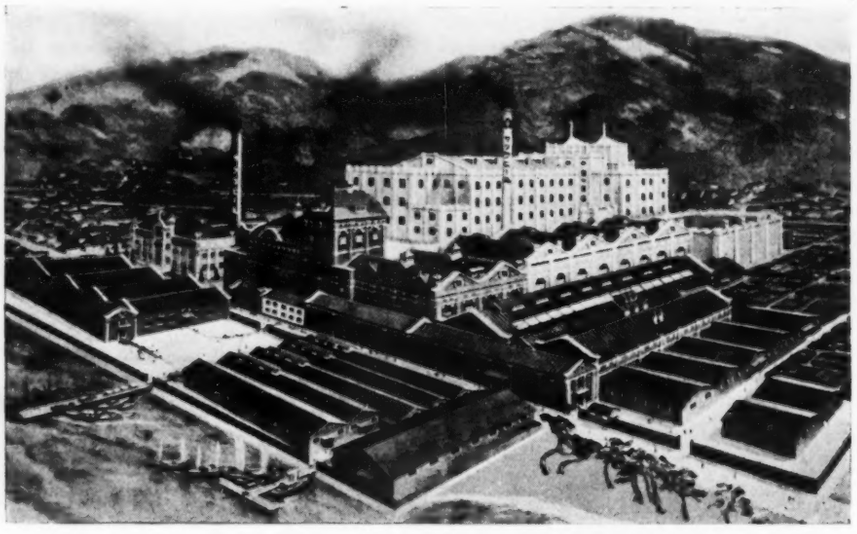
The three heaviest load centers are known as the Kei-Hin, comprising Tokyo and Yokohama; the Chukyo or Nagoya district, and the Kei-Han or district surrounding Kyoto, Kobe and Osaka. By reason of the geographical locations of the Japanese Alps and the River Tenryu these centers are divided into two zones, known as the east zone and the west zone, the former covering the Kei-Hin and the latter both the Chukyo and Kei-Han. The transmission lines under operation at present are shown in the accompanying table.

Since 1921 the installation of 60-cycle machines has surpassed that of 50-cycle, and at present the ratio of the 50 to 60-cycle machines is about two to three.

One of the greatest factors toward increased power

demand in Japan has been the chemical industries. The total required for all purposes in 1915 was 486,000 hp., while in 1925 it had reached 2,087,000 hp., and the Japanese engineers estimate that it will reach a total of 3,500,000 hp. before the end of 1928, with the demand still growing.

In 1927 there were 791 new companies authorized to engage in business, the majority of which were all power consumers. This represented new capital totaling 714,468,000 yen, or approximately $357,234,000. There were seventeen new electric companies included in this group, with a total capital investment of 59,700,000 yen, or $29,850,000. In addition, 248 companies were authorized expansions with a new capital investment of 844,012,000 yen, or $422,006,000, and of this group there were 47 electric companies whose expansion called for an investment of 255,381,000 yen, or $127,690,500. One of the most interesting developments in the industry is the combination of the Shibaura Works and the General Electric Company, the Tokyo Denki and the Westinghouse, the Furuhawa and Siemens-Schuckert, the Nippon Dento and the Western Electric Company, a combination which promises much for electrical progress in Japan and a standardization along American lines.



Plant of the Teikoku Brewery Company at Moji, Japan

This is typical of the many completely motorized industrial plants of Japan. The architecture and layout of plant and buildings are similar to many American factories.

The six premier Japanese cities now claim an installation of 6,208,000 lamps representing 134,643,000 cp., which is 25 per cent of the total for all Japan. In Japan proper there were 27,320,740 lamps in 1925, representing 461,073,576 cp., or an average of 283 lamps per 100 households and 772 cp. per 100 people. At that time the cities represented from 22 to 29 per cent of the total Empire light installations, but this ratio will be vastly changed in 1928 due to the enormous suburban and rural installations both for lighting and heating and cooking. The total lighting installations in the entire Japanese area on meter system were 574,268,000 cp. at the end of 1925. This has increased fully 50 per cent during the past three years, and there is still room for further development as soon as the available power plants and lines under construction make home installations possible. The development of the modern small home in Japan, especially in the large suburbs of the major cities, is responsible for a tremendous increase in outlets for electrical appliances. With those who can afford it, the electric range is finding great favor and promises a very steadily growing demand for the lighting companies.

The development of electric lighting has made deep inroads on the business of the gas companies, most of whom owe their existence today to their byproducts of coal tar, coke and hartshorn. The number of gas lamps has been cut to 60 per cent since 1925, which has been somewhat offset by 300,000 new gas-heating installations since 1921, but, on the other hand, the motive horsepower in the gas companies has dropped from 11,455 to 6,648 in the past seventeen years, with only a slight improvement since 1925, and this latter is now being rapidly cut again by the installation of electric stoves.

The electrification of the railroads has followed as a natural course to the development of hydro-electric plants. These transportation lines, as well as the city tramways, are gradually being encroached upon by the rapidly developing bus lines. The present plan of improving the highways promises still greater inroads into the tramway lines, many of which would be forced to close today but for their real estate and suburban development departments. The loss of the tramways, if and when that takes place, will not materially affect the power companies, which cannot supply the domestic and industrial demand at the present time.

The Tokyo Electric Light Company was the pioneer in the industry, starting in 1887 and generating its power from coal. The lack of training and technical education of the Japanese engineers retarded electrical progress more than any other factor prior to 1907, at which time

Rivers—Japan Sea Group

Names	Average Amount, Horsepower	Names	Average Amount, Horsepower
Akano	536,243	Joganji	92,856
Hime	145,287	Mogami	213,785
Kurobe	311,220	Shinano	721,575
Kuzuryu	120,656	Sho	292,268
Juitzu	416,341	Tetori	80,464

Rivers—Pacific Ocean Group

Abukuma	111,507	Kitakami	114,574
Fuji	288,872	Oh-i	151,546
Kino	72,187	Tenryu	594,062
Kiso	686,115	Tone	158,460

Transmission Lines in Operation

EAST ZONE

Name of Line	Name of Owner	Mileage	Voltage
Inawashiro line	Tokyo Electric Light Company	140	115,000
Joetsu line	Tokyo Electric Light Company	130	110,000
Kohshu line	Kei-Hin Electric Power Company	125	55,000
Average East Zone line		132	93,333

WEST ZONE

Suhara-Osaka line	Daido Electric Power Company	150	70,000
Sasatsu-Osaka line	Nippon Electric Power Company	190	154,000
Average West Zone line		170	112,000

Generation and Frequency

Installed Generator Capacities at Different Frequencies at the End of June Over Stated Periods

Year	Kilowatts at 50 Cycles	Kilowatts at 60 Cycles	Kilowatts at Miscellaneous Frequencies	Total
1912	117,000	137,000	60,000	314,000
1915	160,000	234,000	80,000	474,000
1917	290,000	297,000	104,000	691,000
1919	387,000	429,000	38,000	899,000
1921	504,000	708,000	194,000	1,316,000
1927	616,000	1,719,000	244,000	2,579,000

many of the foreign-trained students began to return to Japan. To this was the added shortage of trained linemen, power station employees and general electricians, a deficiency which is now greatly overcome. Hydro-electricity now occupies the foremost position of all industry in Japan from the standpoints of investment and expansion. Today there is a growing tendency to consolidate all of the many electric companies under a few limited heads and to restrict grants to any new companies, but not under any governmental ownership plan. The main object is to standardize systems, appliances, voltages and general operation and to furnish power, heat and light at fair prices without "cut-throat" competition.

The Tokyo Electric Company now has a paid-up capital of 350,000,000 yen, or approximately $175,000,000, which makes it the largest corporation in Japan. The Tokyo Electric Power Company has grown steadily until its paid-up capital totals approximately $65,000,000, and the Daido Denryoku's capital is now approximately $56,500,000. This latter company opened its line from the Kiso River plant to Osaka in March, 1922, transmitting at 70,000 volts. It now has an additional 300 miles of line into Tokyo. The lighting stage with all of these major companies is past and they are now concentrating on power development. This does not mean that they are selling light current to 100 per cent of the homes, but that they have about all of the load they can handle with the present stage of power development, and all of them are now forced to concentrate on increased generating capacity to keep pace with the constantly growing demand for both lighting and power service throughout the empire.

Modern Japanese bungalows completely electrically equipped. A street scene in Nishinemiya, Japan

The natural resources of Central Japan include the most important heads for electrical generation, and on this account it is the section best adapted for industrial expansion. The Daido Denryoku Electric Company from its Kiso River system in the Alpine tableland is now supplying service at 154,000 volts to the five cities in Tokyo, Yokohama, Kyoto, Kobe and Osaka, with branch lines into Nagoya, for industrial uses.

The survey made by the Japanese government during 1923 determined that there were 2,822 power sites available for development and that 6,415,000 hp. was available as a minimum in case of drought, with 14,093,000 hp. available at maximum at normal, or 11,933,000 hp. as a yearly average. Since the future of Japan depends upon a maximum industrial development, the electrical engineers now plan for a maximum hydro-electric development toward that end. The Shinano River, with its available 721,575 hp., is receiving first attention for that maximum development at the present time.

Large electrical equipment is now being produced at the Shibaura Works, at the Mitsubishi Kobe Shipyards, at the Kawakita Works and at Kuhara's Hidachi Engineering Works. At these plants they are manufacturing generators of 20,000 kva. and motors up to 5,000 hp. The growing activity of water-power development in Japan and in neighboring countries now gives excellent promise for the future of the water-wheel industry. The Japanese factories can now deliver steam turbines of 10,000-kw. capacity and over. All types of electrical equipment and devices are being manufactured on an ever-increasing scale. This promises to be one of Japan's most reliable sources of industrial income as soon as the electrical march of progress extends into Manchuria and throughout the Orient and accounts for the latest moves of combination on the part of the major American companies. Japan is now entirely self-supporting in all lines of telephone and telegraph apparatus, electric fans and all household appliances. The home consumption of coal is now increasing at the rate of 25 per cent per annum and constitutes one of the major problems. The supply and demand is shown in the accompanying table.

Coal Supply and Demand

Year	Output, Tons	Import, Tons	Export, Tons	Consumption
1925	31,459,000	1,740,000	2,694,000	29,903,000
1926	31,427,000	2,012,000	2,590,000	30,184,000
1927	20,096,000	1,912,000	1,624,000	20,309,000

Due to the low production in 1927, the consumption also decreased on account of the high prices which prevailed during the year. This resulted in a greatly increased demand for electricity for heating and cooking as well as power purposes.

Experience with Fireproofed Cables

From report of N.E.L.A. sub-committee on cable sheath damage and protection, L. P. Hicks, chairman.

Material	Company	Extent of Use	Method of Applying	Experience Data
Woven asbestos listing.	Edison Elec. Ill. Co. of Boston.	Single-conductor arc and primary circuits since 1909.	Wrapped spirally and painted with protective fireproof paint.	Effective against ordinary arcs. Provides fair degree of heat insulation. Ease of application makes desirable.
Asbestos listing.	Dayton Power & Light.	20 years.	⅛-in. and 3-in. listing.	Ample protection, especially with ground relay protection.
Asbestos listing tape.	Puget Sound Power & Light Co.	14 years.	Not given.	Inexpensive, ineffective in general manhole fills.
Asbestos listing.	Stone & Webster, Inc.	4 years.	1–16-in. x 2 and 3-in. asbestos listing.	Small protection, insufficient on heavy burnouts; used only on temporary work.
Asbestos listing.	Charles H. Tenney & Co.	16 years. No longer used.	Not given.	Found to cause pitting of cable sheaths in wet manholes; effective in two instances at least.
Fire felt (an asbestos sheet fabric similar to Niagrite).	Edison Elec. Ill. Co of Boston.	Three-conductor trans. cables and two-conductor d.c. feeders 1909 to 1917.	Two layers built-up of 9-in.x36-in.x⅛-in. sheets bound with copper wire. Fireproof paint applied.	Satisfactory, but replaced by cement with supposed better arc-resisting qualities in 1917.
Cement.	Edison Elec. Ill. Co. of Boston.	Large cables since 1917.	⅛-in. coat applied to ¼-in. hemp rope spirally wound since 1919. Cement extends to within 1 ft. of duct edge and fire felt up to duct.	Excellent fireproof protection. Disadvantages, weight and inflexibility. Cement is more resistant to water than is fire felt.
Cement, sand, cloth.	Union Gas & Elec. Co.	13,200-volt cables, 10 years.	Not given.	Effective experience justifies use.
Cement and cheesecloth.	Cleveland Electric Ill. Co.	Not detailed.	⅛-in. Portland cement wrapped with cheesecloth.	No damage to adjacent cables in burn-outs; satisfactory.
Cement, sand and rope.	Commonwealth Edison Co.	Not given.	¼-in. jute rope wrapped on ⅜-in. centers with ⅛-in. covering of 1½ parts sharp sand, one part Lehigh cement.	No damage to adjacent cable under most severe failures where properly fireproofed.
Portland cement.	Duquesne Light Co.	3 years.	¼-in. hemp rope as binder for ⅛-in. cement one to one mixture.	No failures of adjacent cables due to burn-outs—cement and rope fused until lead was exposed. Some corrosion due to free lime.
High test cement (no lime).	Duquesne Light Co.	1 year.	⅛-in. coat of one to two cement.	No failures of adjacent cables due to burn-outs. Cement was fused to the lead on adjacent cables. Slight damage to the lead on two cables.
Cement on rope.	Georgia Power Co.	2 years.	Not given.	In two d.c. cable failures fireproofing on cable which failed, broken off but not injured on adjacent cable 18 in. away. Fireproof cables adjacent to unfireproofed one which failed were not injured, while unfireproofed ones were burned.
Rope and cement.	Louisville Gas & Electric Co.	12 years.	Lead sheath is covered with a layer of cheesecloth and paraffin before rope and cement applied.	Effective under all conditions of burn-outs.
Rope and cement.	Milwaukee Electric Rwy. & Light Co.	Not given.	⅛-¼-in.	Fully convinced of effectiveness of this method for protecting adjacent cables.
Hemp or jute rope and cement.	N. Y. Edison Co.	Years ago.	Not given.	Abandoned on account of the smoldering of the rope durin and after burnout.
Asbestos steel tape and cement.	N.Y. Edison Co.	Very little used.	Not given.	Not given.
Wire lath and cement.	N. Y. Edison Co.	About 16 years.	Not given.	Very satisfactory, but abandoned on account of difficulties of installation.
Cheesecloth and cement.	Philadelphia Elec. Co.	Not given.	Cheesecloth soaked in paraffin and high test Portland cement.	99 manhole failures in 1927-28 led to but one failure of adjacent cable and that at an unfireproofed plant. No trouble in completely fireproofed cables.
Rope, sand and cement.	Public Service Elec. & Gas Co.	Present standard used for 15 years.	¼-in. hemp rope with ⅛-in. open lag and covered with 50–50 cement and sand mix to total thickness of ⅛-in.	Completely satisfactory.
Asbestos sheet.	Brooklyn Edison Co.	Not given.	Not given.	Loosens under frequent submersion and loses protective value. Use justified by results.
Asbestos transite board.	Puget Sound Power & Light Co.	7 years.	Not given.	Expensive; fully effective; difficult to install.
Asbestos tape and silicate of soda.	Union Gas & Elec. Co.	Direct-current cables, 2 years.	⅛-in. tape, no details.	Justified and desirable cables surrounding burn-outs damaged, but do not fail.
Asbestos tape and sodium silicate.	Detroit Edison Co.	All manholes, several years.	Two wrappings of 3–32-in. asbestos tape dipped in sodium silicate solution butt-lapped.	Advantage of being applied while splicer waits for compound to cool prior to final filling. Does not crack. Not entirely satisfactory; some burn-outs occur in adjacent cables, but best known plan for them.
Niagrite and Asbestoment.	Duquesne Light Co.	6 months.	¼-in. x 3-in. Niagrite with Asbestoment treatment. Double layer butt-wrapped.	No failures have occurred to date.
Niagrite and Asbestoment.	New Orleans Public Service, Inc.	Approx. 4 years.	One layer of Niagrite tape applied without lap and with burlap outside covered with ⅛-in. coating of Asbestoment cement paste.	Only one case of failure of fireproofing in period of 4½ years. One cable in six damaged, but continued to operate.
Niagrite and Asbestoment.	New York Edison Co.	3 or 4 years.	Not given.	Very little used on account of cost.
Cheesecloth, sand and cement.	Public Service Elec. & Gas Co.	No longer used.	Same as previous except cheesecloth used instead of rope.	Abandoned because of difficulty of obtaining an even thickness of cement.
Wire lath, sand and cement.	Public Service Elec. & Gas. Co.	No longer used.	Same as previous except cheesecloth used instead of rope.	Abandoned because of difficulty of handling wire lath.
Cement.	Puget Sound Power & Light Co.	5 years.	50–50 cement and sand with a little clay.	Expensive; effective so far.
Cement and cheesecloth.	Toledo Edison Co.	5 years.	Cable covered with a mixture of ¼ cement and ¾ yellow sand with double wrapping of cheesecloth.	Always proved satisfactory.
Cement and rope.	Union Electric Lt. & Power Co.	5 years.	Not given.	Effective up to one hour exposure to burn-out.
Cement and rope.	Washington Water Power Co.	Not given.	⅛-in. thickness of protection.	Only one burn-out reported on, but found fully effective in extreme condition.
Cement, wire, bricklath.	Detroit Edison Co.	No longer used in manholes, but still applied in stations.	Lath shaped around cable and covered with cement asphaltum paint applied to cable first.	Complete wire cylinder served as shield against signal currents for exploring oil. In damp locations disintegration of lead due to electrolytic action and free lime took place.
Niagrite and Asbestoment.	Potomac Elec. Power Co.	4 months all classes of cables.	⅛-in. Niagrite and ⅛-in. Asbestoment.	Adapted after comparative tests.
Niagrite and Asbestoment.	Puget Sound Power & Light Co.	1 year.	Not given.	Comparatively inexpensive; effective so far.
Asbestos and Asbestoment.	Stone & Webster, Inc.	6 years.	⅛-in. asbestos, loose rope with Asbestoment filling applied. Cable and joint are coated first with high grade asphaltum paint.	100 per cent effective; easy to apply, neat looking job.
Niagrite and Asbestoment.	Worcester Electric Light Co.	Not given.	Applied without any intermediate substance.	No burn-outs; effectiveness not known.
Cheesecloth and Asbestoment No. 4.	New York Edison Co.	About 1½ years standard since 1927	Not given.	Number of high-tension feeder burn-outs in manholes; 112; cases where adjacent cables were unaffected, 99; adjacent cables scorched but not damaged, 4; cables damaged, 2.
Niagrite.	Pacific Gas & Electric Co.	12-kv. cables 20 years.	Strips of asbestos dipped in silicate of soda and wrapped in. cable.	Very effective.
Asbestos.	Potomac Electric Power Co.	10 years, H.T. cables only.	Not given.	Good protection.
Asbestoment.	Staten Island Edison Corp.	33-kv. and 2,300-volt cables.	Not given.	Satisfactory, but subjected to few burn-outs.
Asbestos tape.	Worcester Electric Light Co.	Not given; no longer used.	Not given.	Considerable value, but few burn-outs limit data.

Costs in Rate Making*

Development of three-part rate schedules to follow cost curves eliminates discrimination. Analysis and determination of factors composing rate elements

By CHARLES H. DAUCHY
Iowa Railway & Light Corporation, Cedar Rapids

Discussions of rate-making methods, cost allocations and related maiters appear periodically in ELECTRICAL WORLD. *While such articles are addressed to specialists, other persons should know what goes into the making of rates. Every person in the electric utility business should have at least a general understanding of the subject. To them we commend this paper of Mr. Dauchy's as being a plain and easily comprehended exposition of the position of an important school of thought in the rate-making art.*

THE principle is well established that the expense of electric service may be apportioned between three measurable elements, namely, consumer, capacity and energy. The consumer element consists of those costs which vary directly with the number of consumers and consists of such costs as interest, depreciation, maintenance, insurance, taxes and operation of that part of the distribution system represented by similar costs of a theoretical distribution system of sufficient capacity only to deliver the proper potential to each consumer's meter loop. Consumer costs also include all of the costs of reading the meters, keeping records, billing, collection and expenses incident thereto and franchise costs. Average unit monthly consumer costs will result when the total consumer costs are divided by the number of consumer months. Averages, however, should not be used, but the departure from averages will be discussed later.

The capacity element includes those costs which are created as a result of providing for the maximum loads of consumers, such as interest, depreciation, insurance, taxes, maintenance of power plants and a part of the operation of power plants, the interest, depreciation, insurance, taxes, maintenance and operation on transmission systems and the part of the same costs of the distribution system not chargeable directly to the consumer element. The capacity costs are sometimes called reservation costs, as they represent the costs of that portion of the distribution system, transmission lines and power plants reserved for the use of a consumer and generally on demand without notice. An accurate average demand charge may be found by dividing the total capacity costs by the sum of the consumers' demands, but such a charge is not equitable and non-discriminatory. Consumers with load factors above the average would be charged less than their fair costs and those with load factors below the average would be charged more than their fair costs. The equitable charging of capacity costs, therefore, requires the use of kilowatt and kilowatt-ampere demand meters.

The energy element includes those costs which vary directly with the number of kilowatt-hours switchboard output. Average energy costs may be obtained by dividing the energy costs by the number of kilowatt-hours switchboard output. Such average costs, however, should not be used, but the departure will be discussed later.

There are differences of opinion as to just which cost element some expenses should be allocated, but it is believed that as more detailed information is available the allocation will be based more and more on facts and less and less on opinions until different results due to differences of opinion will be negligible. The Iowa Railway & Light Corporation is making refinements in its formulas, but it is thought, when completely refined, the resulting per cents will not give final results much different from those heretofore obtained, even though some of the per cents may be considerably modified.

Column 1 of the accompanying tabulation shows the ratios used by the Iowa Railway & Light Corporation six years ago, column 2 the ratios more recently determined and column 3 the ratios used by another prominent company.

In any rate system it is necessary to make classifications of services. In an ordinary distribution system the usual general classifications used are residence lighting, commercial lighting and industrial power. If each such classification were served by a separate distribution

	Consumer Per Cent			Capacity Per Cent			Energy Per Cent		
	1	2	3	1	2	3	1	2	3
Power House									
Investment expenses				100	100	100			
Fuel							100	100	100
Boiler room labor						50	100	100	50
Water for boilers							100	100	100
Lubricants				100	100				
All other power plant expenses				100	100	100			
Transmission and Transmission Substation									
Investment expenses				100	100	100			
Operating expenses				100	100	100			
Substation (transmission center)									
Investment expenses				100	100	100			
Operating expenses				100	100	100			
Local Distribution									
Distribution substation				100	100	100			
Poles, towers and fixtures	50	35	50	50	65	50			
Overhead conductor costs	50	30	50	50	70	50			
Service costs	90	90	100	10	10				
Line transformer and devices costs	10	30	50	90	70	50			
Transformer core loss	10	30	100	90	70				
Meter cost	60	88	100	20	12				
Meter shunt coil loss	100	88	100		12				
Franchise cost	100	100	100						

**Based on paper presented before Electric Meter Short Course, Iowa State College, Ames, Iowa.*

system the determination of the elements of cost for each would be much simpler, but since such individual distribution systems would not be economical the costs must be apportioned so as to distribute the benefits of consumer density and diversity between the classes as equitably as may be economically practicable. This phase of the problem will be considered under the discussion of each element.

The consumer element varies with the different classifications of services. There is a greater consumer expense in the residence and power classes than in the commercial class, chiefly due to the difference in the number of consumers served per unit of distribution system. The service lines are on an average longer, there are fewer consumers per block and it takes the meter reader longer to read the meters for a certain number of residence and power consumers than the same number of commercial lighting consumers. It has been found that the unit consumer cost decreases as the size of the city increases, but not directly in proportion to population.

The energy costs are first allocated to various towns after properly allowing for transmission line and substation transformer losses. In determining the unit energy cost per kilowatt-hour used by consumers of any town it is necessary to credit the energy costs thus allocated with the cost of distribution transformer core loss and meter shunt loss costs computed at the average unit energy rate for the town and to debit capacity costs with a similar amount. The unit energy cost for each town is then found by dividing the adjusted energy costs by the kilowatt-hours used by the consumers of each respective town. It has been found that the energy element varies with the size of town or city due to the higher percentage of losses in similar distribution systems.

The determination of the equitable unit capacity charge is not as simple as the determination of unit consumer and energy charges. It cannot be found by dividing the capacity costs by the sum of the consumers' kilowatt demands, although the value thus obtained is an accurate average kilowatt demand cost. In other words, although this method gives a charge which distributes the benefits of diversity equitably, it does not weigh load and power factors. It is in the determination of equitable unit capacity costs that demand meters and the type of meters play such an important part and why an economical kilovolt-ampere is so badly needed for less than unity power factors.

Three important considerations essential in the determination of capacity charges are diversity factor, load factor and power factor. There are many diversity factors to be given consideration in a rate structure. There is diversity within a single residence consumer; for example, when the washing machine is being used there are very few lights burning, and when the iron is in use the sweeper is idle. There is diversity between the consumers of a class and between classes of consumers. For example, the maximum demand of power consumers does not coincide with the maximum demand of the commercial lighting consumers.

Another factor essential to the determination of capacity charges is load factor. Load factor is defined as "the ratio of the average load on the system for a given period to the maximum load occurring on the system during that period." Many tests indicate that the load factor of residence consumers with the same equipment is practically the same. Some may use more kilowatt-hours than others, but the demands will be larger in approximately the same proportion. It is because of this fact that a demand meter is not considered necessary for residence service nor need the demand charge appear as a definite item in the rate. An average step rate can be developed which will be equitable and non-discriminatory within an economical degree, provided the consumer charge is kept as a distinct charge. By similar tests we find that the load factors in the commercial lighting and power classes vary greatly even between consumers in the same business; for example, a drug store on one side of the street may have a demand of 1 kw. and a consumption of 200 kw.-hr. per month, while a drug store on the opposite side of the street may have a demand of 2 kw. and a consumption of only 50 kw.-hr. per month. For this reason, rates for commercial lighting and power to be equitable and non-discriminatory must definitely weigh demand.

The third essential factor in the determination of capacity charges is power factor. Power factor is defined, in brief, as the true watts divided by the apparent watts. The economic feature existing in kilovolt-ampere demand rates and which does not exist in kilowatt demand rates may be illustrated as follows:

A consumer having a 1,000-kw. load at 50 per cent power factor will pay, on a kilovolt-ampere demand rate, twice as much for capacity as he would on a kilowatt demand rate, and if the rate is $2.50 per kilovolt-ampere of demand per month, he could, by bringing his power factor up to unity, reduce his power cost by $2,500 per month, which would be a great inducement for him to install power-factor-corrective equipment, and if corrected to unity the power company will have 1,000 kva. of capacity released for use in serving other consumers.

Formula for Capacity Charge

It is evident that where customers' demands are used as the only basis of measuring the capacity charges discrimination will result between consumers with different load factors, so that a method must be used for apportioning capacity charges which weigh the load as well as the diversity factor. Two methods have been worked out which, when applied, produce a value which represents the portion of the capacity costs which may be considered as varying with the number of kilowatt-hours used and another value which represents the portion which may be considered as varying directly with demands so that a portion of the capacity expenses may be charged by a kilowatt-hour rate and the balance of capacity expenses may be charged by a demand rate. The former charge is combined with the energy charge. The first method is to apportion capacity costs between used capacity and unused capacity by the ratios that the average hourly load of the system bears to the annual peak load of the system minus the average hourly load. The used portion is divided by the kilowatt-hours sold, giving the unit kilowatt-hour capacity cost. The unused portion of capacity costs is divided by the difference between the sum of the consumers' maximum demands and the average hourly load of all of the consumers. The unit demand rate thus obtained may be applied to each consumer's maximum demand minus his average hourly load. The other method is a mathematical solution and is obtained from solving two algebraic expressions as follows:

$$Kx + Dy = C$$
$$Hx + y = \frac{C}{P}.$$

where

x = The cost per kilowatt-hour of that portion of the capacity costs that may be considered as functioning with the kilowatt-hours supplied the consumers.
y = The demand cost per kilovolt-ampere of that portion of the capacity costs that may be considered as functioning with the maximum demand of the consumers.
D = The sum of the consumers' maximum demands.
P = The maximum coincident demand or peak responsibility of all consumers on the sources of supply.
K = The kilowatt-hours used by all the consumers in a year.
C = The total annual capacity expenses of all consumers.
H = The number of hours in the allocation period.

The second expression is the cost for a consumer with 1 kw. demand at 100 per cent load factor and unity power factor for the allocation period.

Both methods give identical results. The second method is more convenient for use because the consumers' demands are used direct without deducting the average hourly load and using the difference for the billing demand. Both methods take care of load factor and diversity factor for the period in which allocations are made, since the equations involve both load factor and diversity factor. (D/P). Changes in systems' loads and diversity factors as a whole occur very gradually, consequently charges based on a one year's allocation may be used for a number of future years, or until there is a change in power plant loads and diversity factors or a change in capacity cost per unit of annual peak loads. Unit capacity costs thus obtained are found to be more in smaller cities than in larger cities, the same as in the case of unit consumer and unit energy costs.

When the consumer expense is combined with the correctly allocated capacity and energy expenses a three-part rate, which can be termed a cost curve rate, will result and will read as follows:

A consumer charge which includes those costs which vary with the number of consumers.

A kilovolt-ampere charge which includes that part of the capacity costs which can be made to function with the consumer's demands.

An electricity charge which includes the energy costs and that portion of the capacity costs which can be made to function with the number of kilowatt-hours used.

The Iowa Railway & Light Corporation has been offering for several years optional rates of the above form but higher than costs, although with values which parallel the cost curve. It is its hope ultimately to have all of its business on rates which are based on the cost of service to the consumer, thus eliminating the discrimination that is inherent in the usual political rate.

What Voltage Margin for Rubber Gloves?*

By F. M. Farmer
Chief Engineer Electrical Testing Laboratories

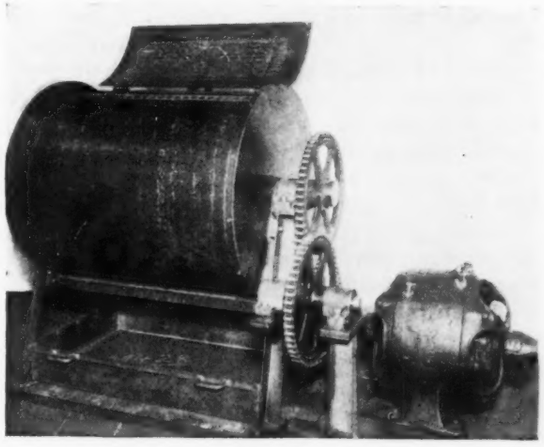
WHAT should be the margin between the voltage at which rubber gloves are tested and that at which they are used? What determines the limiting voltage at which they should be used?

The A.S.T.M. requirement corresponds to a factor of the order of 5 so far as dielectric strength is concerned. Considering that this is under test conditions where the glove is under no mechanical stress of any kind and that a factor of 2.5 or 3 is required in most electrical equipment where no human hazard is involved, it would seem that a factor of 5 under the test conditions is small enough. However, the leakage current is likely to be the limiting factor, because the permissible value is a fixed quantity irrespective of the voltage. The A.S.T.M. limit of 10 milliamperes at 10,000 volts under the prescribed test conditions was fixed on the basis of actual studies of current which would cause mild electric shock under the conditions of use. If, therefore, gloves are to be used at 5,000 volts, for example, the breakdown voltage should be not less than 25,000 volts and the leakage current should not exceed about 0.6 milliampere per thousand volts. In other words, the electrical impedance of a glove should be increased not less than in proportion to the voltage at which it is proposed to use it.

A voltage test for gloves intended to be used at not over 3,000 volts should never be less than 10,000 volts for either new or old gloves and the time should never be less than three minutes. A test of 10,000 volts provides a factor which is none too large in view of the lack of control over the uniformity of the product, not only when new but particularly after having been in service. As to the time, the short time test is about as effective as a long time one in eliminating defects of a strictly mechanical character, but time is required to develop electrically weak spots into failures. It may be argued that such defects usually develop into failures through the generation of heat at the defect, but that with water electrodes such heat is carried away, and therefore, the longer test does not accomplish anything. While water electrodes doubtless reduce the effect of the time element, nevertheless it is believed that one minute, as advocated by some, is much too short a test period.

Written at request of National Safety Council.

Salvaging Lamp Bases



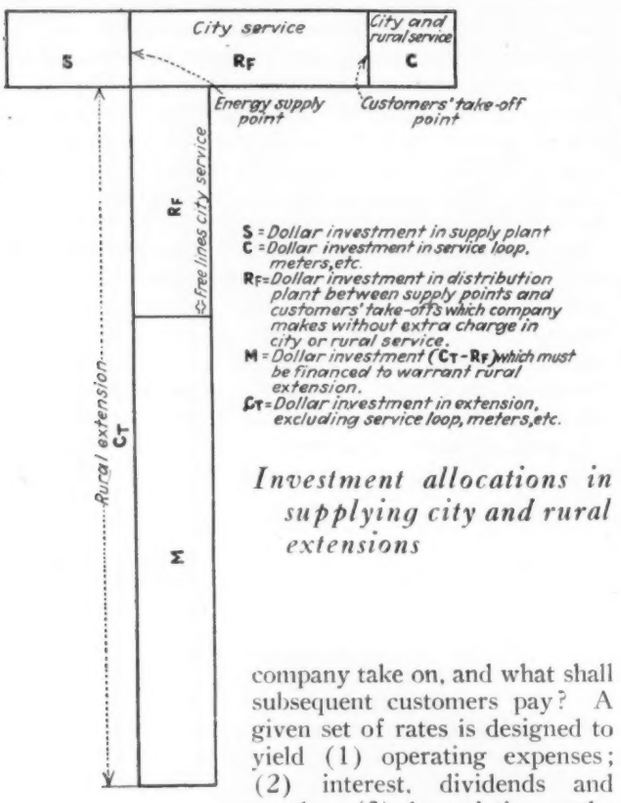
IN ORDER to reclaim the brass shells of the 300,000 incandescent lamps used annually in its offices, stations, etc., the New York Edison Company has devised a "rumbler" which by fully separating the glass, wires and cement from the brass shells permits the sale of scrap metal at highest prices.

A revolving steel cylinder with perforated sides is mounted in the machine illustrated and may be partly filled with 300 to 500 old lamps. Two long steel-pronged bars are likewise placed in the cylinder. All material except the reclaimed shells falls into the steel drawer on the base as the cylinder rotates.

Attacking Rural Extensions on Unit Distribution Basis

By E. F. Miner
Chase & Gilbert, Inc., Boston, Mass.

IN DETERMINING the economic solution of rural line extension problems it is helpful to allocate fundamental costs to such projects and from this basis to work out a unit analysis leading to the assignment of responsibility for investment and carrying charges. The major questions to be answered are: What shall the customer and the company contribute? What shall the rates and service charges be? How much of the business shall the company take on, and what shall subsequent customers pay? A given set of rates is designed to yield (1) operating expenses; (2) interest, dividends and surplus; (3) depreciation on the tangible property, and (4) taxes. In proceeding to solve an extension problem we obtain from an analysis of capital accounts and company statistics the average investment per customer of a stated class, i.e., "unit distribution invested capital" for domestic customers average and large, for commercial customers average and large and for industrial customers (say retail and wholesale) on a capacity demand basis.


City service
City and rural service
S
RF
C
Energy supply point
Customers' take-off point
RF
Free lines city service
Rural extension
CT
M
S = Dollar investment in supply plant
C = Dollar investment in service loop, meters, etc.
RF = Dollar investment in distribution plant between supply points and customers' take-offs which company makes without extra charge in city or rural service.
M = Dollar investment (CT - RF) which must be financed to warrant rural extension.
CT = Dollar investment in extension, excluding service loop, meters, etc.

Investment allocations in supplying city and rural extensions

In the foregoing paragraph "unit distribution invested capital" means the per customer (of a given class) investment in plant and property between energy supply points and the "take-off" of customers' services. Of the main elements in a given extension situation it is the distribution component which is the major item, over and above the "free line" component, meaning by the term "free line" the proportion of the extension which would be furnished without extra cost by the company as a matter of routine. This might, for example, cover one or more spans away from the main distribution system, and in a particular case might mean that a customer close to a main highway traversed by existing lines would be served off an extension without being required to pay additional capital charges.

In a typical case the analysis of costs on a given property may yield the following unit distribution "free" investment per customer of a stated class (remembering that by "free" investment is meant that portion of the system between energy supply points and the customers' take-offs which the company will finance itself in normal procedure):

Domestic and small farm customers, average	$45
Domestic and large farm customers, average	60
Commercial, small stores, etc.	55
Small power	70

Large power is developed on a demand basis.
Street lighting capital investments for specific small communities may be readily determined.

Having determined the total construction cost for a particular rural extension, we deduct the sum total of the distribution unit investments for the various classifications of service to be supplied. In the diagram, this refers to $C_T - R_F$, which equals M. M is the amount of money which must be raised in excess of the normal company contribution in order that the extension may be made, and this amount is used as a base for the determination of a proper service charge.

A survey of eighteen prospective customers reveals ten average-sized domestic takers, five large domestic users-to-be (to have ranges, farm power and miscellaneous appliances), two average commercial customers operating stores, and a street lighting customer (the town). The total free distribution investment which would be made without extra charge in normal service by the company figures $1,160 ($R_F$ in the diagram), including a "free" investment of $300 toward street lighting. Two of the above domestic customers require, let us say, excess construction above the general average for their class, of $100 each.

The total construction cost C_T, exclusive of supply plant S, services and meter loops C and the $200 excess (for the above two customers) figures, let us say, $4,800. The energy rate takes care of the charges on the supply investment S, the service and meter loop investment C and the "free" distribution component R_F. The difference between the total construction cost C_T and the total free distribution investment of $1,160 is $3,640, or M. The ratio of M to R_F in this case is 3.14 to 1, which may be called the service charge index.

The service charge is developed as follows for the average domestic customer:

$45 x 3.14 equals $141.30, or the excess investment per average domestic customer on the extension. Assuming a rate of return of 15 per cent covering interest, depreciation, dividends and allowance for surplus, 0.15 x $141.30 equals $21 per year or $1.75 per month. This is the service charge determined upon.

Energy prices may be the same as in the city if losses permit.

For the two outlying customers before mentioned the excess investment is $241.30 each, and the service charge on a 15 per cent basis figures $36 per year.

Subsequent additional customers are supplied as follows:

Fifty per cent of the distribution unit investment per customer ($45 to $70 according to class) is added to the last previous total of unit investment R_F and a new service charge index determined. From this a new service charge is determined for all classifications, including the additional customers. Excess construction to serve these must of course be added separately if involved.

Under the above procedure discrimination is completely avoided; rate differentials are eliminated and rural and outlying extensions become a clean-cut problem and a good-will asset instead of a liability.

Operating Experience at Boston with
High-Pressure Steam*

Handling 1,200 and 1,400-lb. equipment at Edgar station. Boiler, pump and turbine performance demonstrates the practicability of development

By ROBERT E. DILLON

Superintendent Generating Department, Edison Electric Illuminating Company, Boston

In this article R. E. Dillon throws open the door of Edgar station and turns the pages of its high-pressure steam-operating records over to the readers of the ELECTRICAL WORLD *in order that a close-up view may be had of the service experience the Boston Edison Company has had with its pioneer 1,200-lb. and 1,400-lb. equipment.*

Following Mr. Moultrop's recent paper before the A.S.M.E. on the effect of these experiences upon station design, Mr. Dillon's companion A.S.M.E. paper gives an extremely clear-cut picture of the major problems encountered by those responsible for operating 1,200-lb. boilers, turbines and feed pump units from 1925 to date. He reaches the conclusion, as did Mr. Moultrop, that high-pressure steam generation is entirely practicable and is meeting and will continue to meet the efficiencies demanded by design engineers.

IN THE previous paper, by I. E. Moultrop, various aspects of high-pressure steam station design and construction were discussed, with particular emphasis upon the Edgar station of the Boston company. This paper's purpose is to recount our experience in operating this plant, stressing the high-pressure equipment.

In the design of the Edgar station it was decided to superimpose a 1,200-lb. pressure plant upon a portion of a plant constructed for a normal pressure of 350 lb., the reheated exhaust of the high-pressure plant partially to feed the 350-lb., 30,000-kw. turbines. This placed the uncertainties of the development upon a minor part of the equipment, a single high-pressure boiler and a 3,150-kw. high-pressure turbine. Aside from a 50-lb. increase in the maximum pressure and an 80 deg. F. increase in temperature the 350-lb. part of the station differs from our previous plants only in the increase from single to two-stage bleeding, the employment of complete alternating-current auxiliary drive and the use of evaporators and deäerators in the boiler feed system. These relatively simple changes have proved to be of decided advantage.

Fig. 1 shows diagrammatically the plan of connecting the original high-pressure equipment to this normal pressure plant. An automatic bypass valve was put around the original high-pressure turbine primarily to keep the high-pressure safety valves from blowing in case the high-pressure turbine tripped out and to contribute to the supply of steam to the 350-lb. main in case the high-pressure unit was out of service.

Motor drive was installed for all auxiliary equipment in order to minimize and simplify the steam piping. We also installed for operation at 350 lb. one emergency normal-pressure boiler feed pump, one emergency high-pressure boiler feed pump, one emergency house generator, one emergency exciter, the starting oil pumps of all turbines and the soot blowers.

We were not certain that a 1,200-lb. safety valve could blow more than once without requiring reseating, therefore two small pilot valves were installed to warn the operators to take steps to keep the main valve from blowing, but these were found unnecessary and have been removed.

Another precaution was the installation of a desuperheater in connection with the automatic throttle trip of the high-pressure turbine to prevent steam when throttled through the by-pass valve reaching an excessive temperature when leaving the reheater. This, too, was found to be unnecessary because of the combined characteristics of this boiler and reheater. Also, as we did not know the exact temperatures which might be reached at the reheater outlet under all conditions of load for this combination, we installed a by-pass damper by which the outlet steam temperature could be regulated. In operation we have never had occasion to use this damper except as a baffle. While ready to fulfill its design purpose it has been kept in the maximum temperature position at all times.

We expected some trouble in synchronizing the high-pressure turbine and a laminated field with a squirrel cage winding was therefore provided in the generator as first installed, so that it could be bussed even though not exactly in synchronism. No difficulty was encountered in synchronizing, but since this special field caused undue vibration the manufacturer changed it to the solid type and thus eliminated the trouble.

FIRST 1,200-LB. BOILER EXPERIENCES

When the first high-pressure boiler was installed no feed water regulators had been developed for that pressure. Although we knew nothing of water level stability in a high-pressure boiler, we expected no trouble in maintaining a constant level in the boiler drum. We had poor regulation, it is true. This was not a function of boiler design, but of the differential pressure across the feed valves, which was several times greater than ever before

**From a paper presented at a recent meeting of the Metropolitan Section of the A.S.M.E. in New York City.*

encountered. Since these valves were hand-operated we had both high and low water. The high water caused no damage, although several times it was carried over into the turbine. The low water, however, may have contributed to the trouble which we have experienced with warped tubes. It cannot be definitely stated that the warping of the lower row of tubes was due to low water, but this may reasonably be assumed. Finally, our

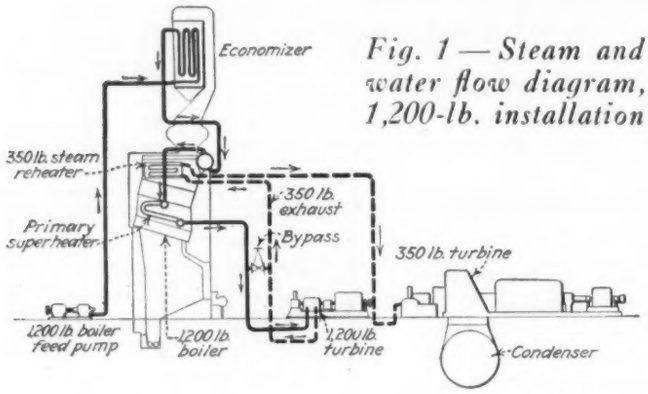


Fig. 1 — Steam and water flow diagram, 1,200-lb. installation

difficulties in feeding the boiler came to an end with the installation of feed water regulators adapted to high pressures.

When the plant was started we had indications of corrosion in our economizers, caused, we believe, by dissolved oxygen in the feed system. Fortunately the economizers in functioning as chemical deäerators apparently saved the boilers from any corrosion. We now run zero oxygen in our boiler feed system, which has practically arrested the corrosion, and we hope to eliminate corrosion entirely by chemically maintaining a slightly alkaline feed.

The drop in pressure between boiler and turbine is greater than expected, cutting down the expected amount of steam through the turbine. Therefore, we run the high-pressure boiler somewhat under the capacity of its stoker except when we are short of 350-lb. steam. In such case we crack the by-pass valve around the turbine. This operation, however, results in an increased line drop, with consequent slight reduction of throttle pressure and reduction of high-pressure unit load. It is impossible to keep the high-pressure boiler on the line over one week when running with the turbine by-pass open on account of slag accumulation on the lower tubes of the boiler. This slag is caused by the high furnace rating. Recently slagging soot blowers have been installed and we hope that this trouble will be eliminated.

The first trouble experienced with the original high-pressure turbine was with the shaft packing. Carbon packing rings were placed in series with two sets of labyrinth packing on the high-pressure end and a single set of the same packing on the low-pressure end. This carbon packing seized and went to pieces. It was replaced with the labyrinth type, which has since proved very satisfactory.

An inspection of the high-pressure unit after 1,600 hours of service revealed bent buckets in the first two and last two rows, as shown in Fig. 2. We were able to account for this and concluded that it must have been caused by some foreign material. The unit was first put in service December 5, 1925, and to December 31, 1928, had 16,042 hours of service out of a possible 26,928 to its credit, generating 31,829,000 kw.-hr. It has been practically a 100 per cent reliable unit, the outage being caused mainly by the necessity for boiler cleaning, as well as by stoker and furnace repairs.

Early this year this machine was opened for inspection. The buckets were corroded and there was also considerable deposit in the nozzles. Five first-stage buckets were found cracked at the root and were removed with five on the opposite side of the wheel to maintain balance. The unit has been closed up and put back in service pending a decision on what is to be done with the rotor. The last stages of the rotor at the time of this inspection are shown in Fig. 3.

The loading of this unit is necessarily a function of the boiler output. Our original intention was to run the boiler at variable pressures according to boiler output, allowing the turbine to drift. But the governor was found to control the unit satisfactorily and it was decided to run the boiler at constant pressure. Our practice is to use high pressure to the fullest extent possible and we have never had to operate with varying pressure. It would have been impracticable to operate this boiler and turbine at varying pressure for reasons connected with later superheater failures.

The loading of the high-pressure turbine and boiler in this initial installation offers no difficulty. We put the equipment in service and allow it to run at a fixed load, the system base load always creating a demand for the exhaust steam.

The feed pumping equipment in the original 1,200-lb. installation consists of a 300-g.p.m., 3,500-r.p.m. pump and a like-sized 4,500-r.p.m. pump. The 3,500-r.p.m. pump is motor-driven and the other pump is steam-driven. The steam-driven pump has given no trouble and has had very little service. The motor pump has been run approximately the same number of hours as the original high-pressure boiler. The principal difficulty with this pump has been wearing of its hydraulic thrust plate, which has to be replaced about once in two months. We had some difficulty in packing this pump at first, but it is now satisfactory in this respect. There was also leakage between the pump shaft and packing sleeve.

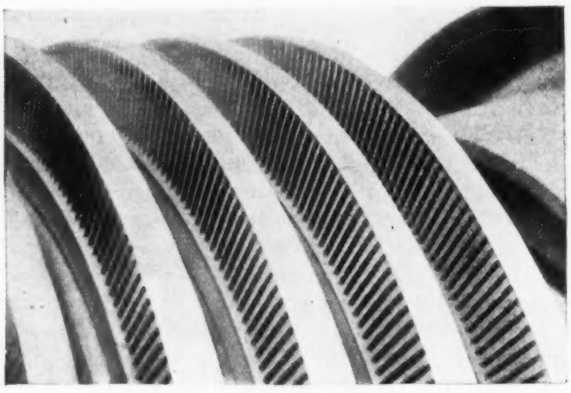


Fig. 2—Buckets of 1,200-lb. turbine after 1,600 hours service

When the time came to put in additional capacity at Edgar station the question arose of continuing with 1,200-lb. pressure at the boilers and reduced pressure at the high-pressure turbine throttles or of increasing the future boiler pressure to give 1,200 lb. at the throttles. In one case we faced an obvious loss in economy due to a reduced pressure and in the other we faced difficulties in operating boilers in parallel and the emergency use of pumps. The final decision was to go to 1,400-lb. pres-

sure for the new boilers, giving 1,200 lb. at the throttle. While this adds complexity to the station as it stands today, the ultimate result will be more satisfactory. We then proceeded to install two 1,400-lb. boilers and one 10,000-kw. high-pressure unit.

Operating Flexibility

The water and steam flow diagrams for the recent 1,200-lb. addition are shown in Figs. 4 and 5. Irrespective of the fact that we have three different boiler pressures, we have a high degree of flexibility in the operation of the plant. Steam from any boiler can be used in any low-pressure turbine, but the distribution of boiler room load between high- and low-pressure boilers is at present under hand control and is now accomplished by the regulation of load on the high-pressure turbines, the low-pressure boilers taking the variations on the automatic boiler control.

In order to make the plant flexible, and for the reason that any boiler can supply steam to any normal pressure turbine, a common tie is necessary at some point in the condensate return. In practice we have had no difficulty in maintaining either proper steam or water distribution in the plant.

The first high-pressure boiler in our recent addition went into service in September, 1927. During the early stages of operation we ruptured several superheater tubes on both of the new high-pressure boilers. Figs. 6 and 7 illustrate two of these failures, which were caused by faulty steam distribution in the superheater. Further failures have been prevented by changing the distribution baffles in the superheater headers and by installing ferrules in the first pass of the superheater.

During the time when ruptures were occurring in the superheater it developed that there was a hazard in running the boiler pressures considerably under the popping pressure of the superheater safety valves. Under these conditions, in case of sudden loss of load on the station, the superheater valve would not blow and thus allow steam to cool the superheater until sufficient steam had

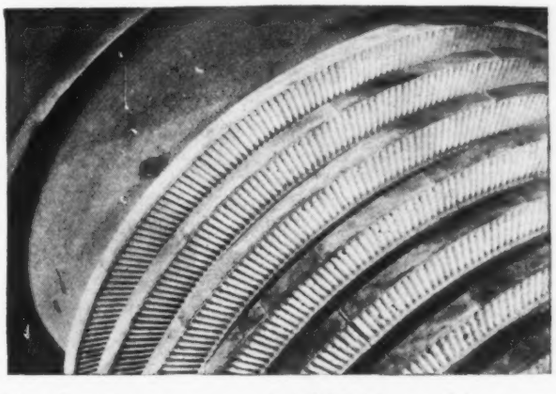


Fig. 3—Last stages of 1,200-lb. turbine rotor after over 16,000 hours service

been generated to raise the pressure in the boiler to the popping point. The interval of time required was sufficient for the superheaters to become overheated. It also developed that calculations for high-pressure boilers should be made with allowance for the higher volume of low-pressure steam so as to permit operation at low pressure.

About the time that superheater tubes were bursting, a rear water wall tube ruptured just above the ashpit (Fig. 8). This was attributed by the manufacturers to faulty circulation due to inadequate capacity in water feeders, recirculators and steam vents from the upper wall header to the boiler drum. The number of feeders, recirculation and steam vent pipes was increased and no further trouble was expected. Recently, however, after the changes had been made, a similar rupture occurred in the rear wall of the other boiler. Fig. 9 illustrates

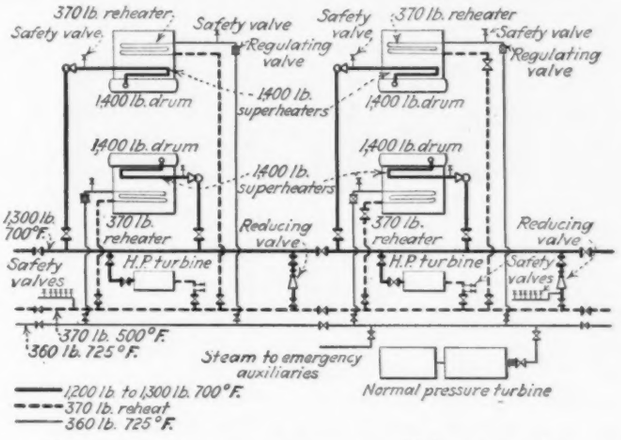


Fig. 4—Piping scheme in Edgar station extension

this failure and shows the larger opening which occurs when the tubes are covered with cast-iron waffle blocks when compared with Fig. 8, where the tubes were covered with steel blocks.

The theory has been advanced that possibly this last water wall failure may be attributed to blowtorch action on the wall. In order to prevent a recurrence of this trouble, refractory-faced blocks were installed in place of the cast-iron waffle blocks near the clinker pit on the rear wall. While this measure may be effective, it is our opinion also that variations in water level in the boiler drum change the hydraulic head sufficiently on the wall feeders to unbalance the circulation and cause trouble. Whatever the cause, it is evident that the condition must be remedied.

Bringing a cold boiler into service has been a frequent cause for leaks of this nature in water wall supply tubes where they are rolled into the drum. The theory advanced is that when starting up and bringing the boiler up to pressure the boiler tubes absorb heat more rapidly than the water walls. This hot water is not drawn from the drum into the water walls, as circulation in the latter has not yet started. Consequently there is a difference of temperature of approximately 200 deg. F. between water wall feeders and boiler drum, causing expansion and leakage at the point of rolling the tube into the boiler drum. This theory is borne out by the fact that artificial circulation caused by bleeding a small quantity of water, while starting up, from the bottom of the wall has caused this trouble to disappear.

Recently it was discovered that several of the 2-in. boiler tubes in the upper bank of the last two boilers had been overheated. One tube was bagged and leaked on one of the boilers, and several others showed signs of distress. Investigation disclosed an exceptional concentration of flame close to the uptake headers extending to the top of the first pass, largely due to the heavy accumulation of slag in the bottom of the boiler. This produced an unusual localization of heat on the bottom tube of the

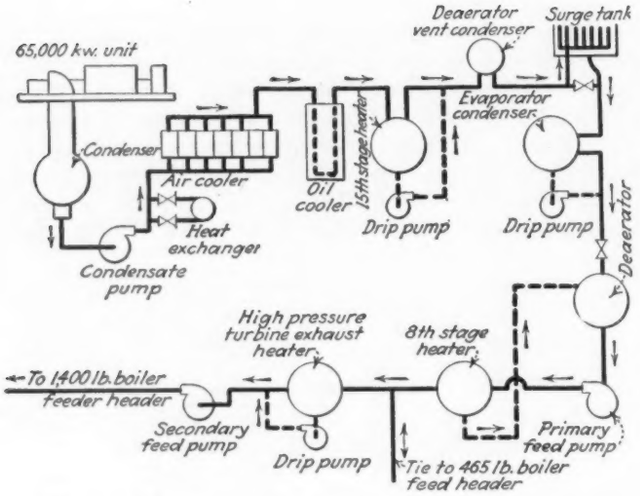


Fig. 5—Condensate and boiler feed system for 1,400 lb.

upper deck. The condition was corrected by diverting water from the lower to the upper bank.

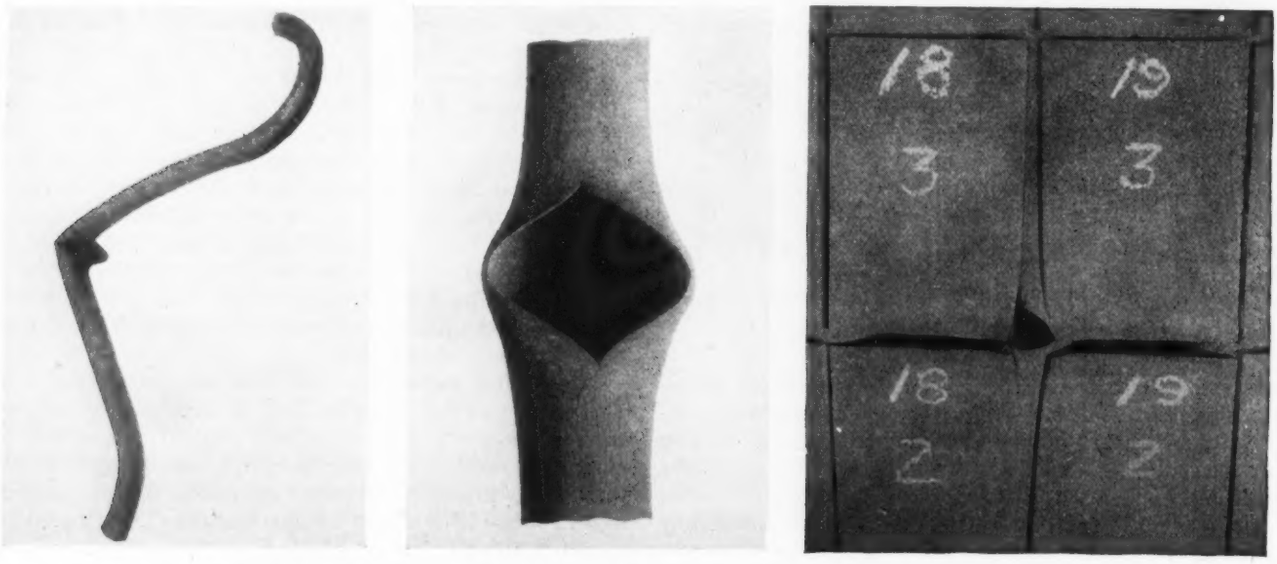
When the new 10,000-kw. high-pressure turbine was put in service it leaked badly at the horizontal joint in the casing. It was sent to the factory and a large amount of metal cut off the flanges to render them more flexible and to permit the use of shorter bolts. When it was opened up, after a very few hours' service, to have the flanges fixed it was found that one bucket was gone from the last stage. The last four stages were rebucketed with heavier buckets.

After these changes this turbine was again put in operation and has since operated satisfactorily. In 1928 this machine ran 3,300 hours out of a possible 8,784, generating a total of 15,684,000 kw.-hr. Its exhaust steam generated approximately 60,000,000 kw.-hr. in the 350-lb. machines. These low figures are primarily due to development and repair work on the new boilers and stokers. The turbine itself was approximately 100 per cent available.

This high-pressure unit is equipped, as will be our third 1,200-lb. unit, with a pressure governor which admits steam to the unit in sufficient quantity to maintain approximately 360-lb. pressure in the turbine exhaust. The load on the high-pressure turbine, therefore, is governed by the pressure in the low-pressure main. The low-pressure main is held constant also by Bailey control for the low-pressure boilers. In this original design it was intended that the Bailey control on the low-pressure boilers should come into play after the high-pressure turbines were wide open. However, as the high-pressure part of our plant is not yet 100 per cent developed, we are setting the speed governor on this unit for the load which the high-pressure boilers can carry and allow the low-pressure boilers to take the swings and maintain pressure. The pressure governor on the present high-pressure unit is set at a pressure above that of the low-pressure main and will function, in case of a sudden decrease in load on the normal pressure part of the station, to shut off steam going through the high-pressure unit and prevent the reheater safety valves from blowing. The Bailey control on the fans of the high-pressure boilers maintains constant pressure on the high-pressure steam main, and under the above conditions would tend to keep the high-pressure boilers from blowing. The by-pass valve for this turbine is opened automatically either by the pressure governor when the 350-lb. main pressure falls or when the turbine trips out.

The pumps installed with the new 1,400-lb. boilers consist of two units in duplicate, connected in series, as in Fig. 9. The first is a 500-lb. unit taking hot water from the deäerator under low head. The water is first passed through a one-stage booster pump mounted on the shaft of the large pump. The large pump is a volute pump of five stages. The only trouble we have experienced with this unit has been hydraulic thrust wear. This 500-lb. unit discharges water through heaters to a secondary pumping unit consisting of a volute pump similar to the five-stage pump and a six-stage turbine pump. These two pumps, comprising the secondary unit, are mounted on opposite ends of a slip-ring motor shaft.

We have had considerable trouble with these secondary pumps. The thrust plates have worn very rapidly and we have been able thus far to run one pump long enough to allow us to repair the other and hold it in reserve for approximately two weeks before it is necessary to repeat the operation. In this manner we have been able to keep the plant in operation during our winter load. One of



Figs. 6, 7 and 8—Superheater tube failures and steel block water wall failure

these pumps recently broke its shaft and caused considerable damage.

Shaft packing has also been a troublesome problem. Metallic packings have given only fair service. We have a high-pressure extraction heater which takes steam from the exhaust of the high-pressure turbine. This heater delivers water at approximately 420 deg. F. in normal operation to the suction of the secondary pumping unit. This hot water accentuated our packing troubles, so we temporarily discontinued the use of the heater. These pumps have been recently rebuilt by the manufacturer with larger shafts, Kingsbury thrust bearings and labyrinth shaft packings. At present, the high-pressure heater is in service and the pumps are operating very satisfactorily.

In addition to these pumps we have a six-stage, 3,600-r.p.m. turbine-driven pump designed to deliver 900,000 lb. per hour from atmospheric pressure to 1,600 lb. per square inch. This pump was originally intended to take water either from the yard storage reservoir at about 4 lb. pressure at 60 deg. F. or from the deäerator under approximately 25 lb. at 250 deg. F. or by means of bypassing the deäerator from the surge tank at 50 lb. pressure and 150 deg. F. No booster is used with this pump, and although its operation is satisfactory when connected to either the yard storage reservoir or surge tank it fails to operate when taking water from the deäerator. To correct this several first-stage impellers were tried by the manufacturer without success. A great deal of trouble was encountered due to vibration and the bushings in the pump seized on several occasions. This pump is largely for emergency use, and as such in taking water from the yard reservoir its operation would be considered satisfactory. However, since its cost is high, we should like to have it available as a spare for short periods, while the other pumps are being overhauled. Under these conditions cold undeäerated water from the yard reservoir or the surge tank would not be favorable to economy or safety. Therefore, it is highly desirable that the pump should work satisfactorily under the normal operating conditions of the other pumps. The manufacturer feels that a first-stage impeller can be designed to function properly under these severe conditions and is now carrying on development work for this purpose. While this is in progress we stand by with the pump connected to the reservoir ready for emergency service only.

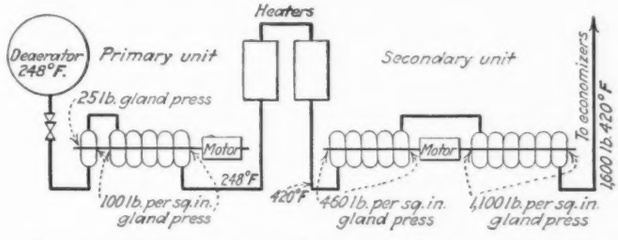


Fig. 9—Simplified boiler feed pump system for 1,600 lb. at 420 deg. F.

During all of our pump trouble it was decided to reset the safety valves on the two 1,400-lb. boilers to blow at the same pressure as the original high-pressure boiler, so that in case we lost all of our new high-pressure pumps we could feed across with the original high-pressure pumps and thus give us additional insurance against burning our boilers. As a result of this arrangement we have a very high differential pressure across our boiler feed valves and consequently have been compelled to regulate our boiler feed by hand. As soon as our boiler pumps are operating satisfactorily we shall return the 1,400-lb. safety valves to their original settings, use the feed water regulators and thus eliminate the danger from hand control.

Fig. 10—Cast-iron waffle block water wall failure

Furthermore, it is difficult to obtain satisfactory boiler feed pressure regulation with electrically driven feed pumps employing slip-ring motors. This is due to the fact that the head capacity curve of a slip-ring motor-driven pumping unit is very steep on account of the well-known speed-torque relation of the motor. This inability to slow down slip-ring motors is a factor also to a slight extent with normal pressure equipment. In high-pressure pumps, however, it is a feature particularly noticeable.

The prime reason for advancing to higher pressures is on account of the gain in economy. Fig. 11 shows the relation between coal consumed per kilowatt-hour generated and percentage of maximum possible high-pressure generation. It will be noted that the fuel consumption of the 350-lb. part of the station under the prevailing conditions represented by the chart is about 1.02 lb. of coal per kilowatt-hour and that there is a gain of 12 per cent with the use of high-pressure equipment to the full extent or when the normal pressure units are supplied entirely by high-pressure unit exhaust. The coal burned is New River semi-bituminous and has 14,050 B.t.u. per pound as fired. Our equipment at

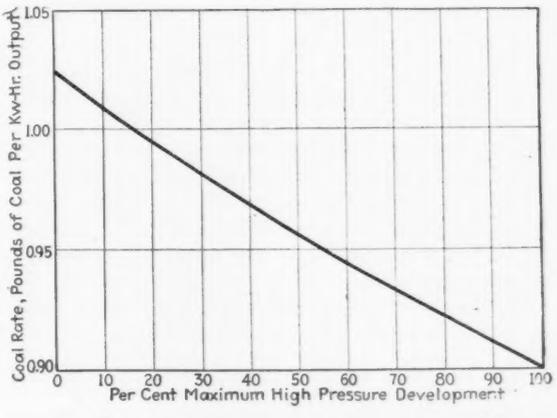


Fig. 11—Increase in coal economy per kilowatt-hour with high-pressure development

Edgar station is partial development so that the fuel consumption of the station should fall only part way down the curve.

After making allowances for the lack of availability of boilers due to boiler, stoker and pump developments and to other unavoidable operating factors, fuel consumption figures fall surprisingly close to the line and confirm the expectation which has been entertained with regard to the high-pressure gain.

Conclusions

A close perusal of troubles always gives an unfavorable impression of any installation. In general, however, all new departures are certain to have small difficulties which require correction, and in this respect high-pressure steam has not developed any difficulty not readily taken care of. It is, therefore, our conclusion that high-pressure steam for electric power generation is entirely practical and is meeting and will continue to meet the efficiencies expected by the designers.

Better Fabricating Results by Arc Welding

Elimination of noise and intricacies of design accompany simplification of machines. Weight of material reduced without losing strength. Experimental work made easier.

ARC WELDING has been used for about five years by the Lewis-Shepard Company, Watertown, Mass., in the manufacture of material handling and storage systems. N. Warshaw, chief engineer, in reviewing the experience of this organization before the New England industrial heating conference, said that in using this type of welding in the fabrication of portable elevators or stackers it was found that better joints were produced than by riveting or bolting. "By better joints," said Mr. Warshaw, "I mean stronger joints, which would last longer without service work or maintenance. These machines are subjected to heavy loads which produce high stresses in the major members. Due to their being self-contained units and generally tall and slender they also attain a natural period of vibration which is effective in loosening up bolts and rivets."

Savings in Material

"The use of arc welding enables us to decrease the weight without decreasing strength through the selection of proper-sized members regardless of such considerations as wrench room, punch and die clearance, rivet bearing, bolt projections, etc. We can definitely calculate the load and stresses and then incorporate the exact section of material to maintain proper factors of safety. Having faith in the arc-welded joint's strength, we know that the cross-section of each member and not the joint determines the weakest part. By arc welding we are able to manufacture many machines which were practically impossible of production hitherto due to the intricacy and lack of accessibility of the riveted or bolted joint. This is true of both very light and very heavy machines. We have found it possible to eliminate many expensive castings through building up the same design of structural steel through arc welding. In taking up this welding work we also believed that the cost of manufacture would be no greater and that the increased labor cost for arc-welding operations would be largely offset by the simplification of the machine, the decrease in the number of operations and greater speed or turnover in production.

"One very important result was the elimination of a great amount of detailed drawing by our engineering department. Arc-welding blueprints generally show the different parts welded into a single unit and eliminate the details showing the location of many bolt and rivet holes. It is of course true that we had to employ more engineering talent in this type of design. Another very important result was the elimination of a great amount of riveting noise in the shop, which surely increases the efficiency of the production department. The lessening of the number of operations was very favorable, as very few parts contained holes, and the principal operations are cutting to length, assembly by clamps or light tack welds, and then the complete welding of the structure.

Prejudice Fades from the Picture

"Our satisfaction was so great that we extended our applications to other products, such as lift platforms, racks, trucks and special equipment. We were also in a position to obtain novel results in the fabrication of all steel and combination wood parts as our knowledge of the art increased. We had to overcome a tremendous amount of prejudice in the progress of this development work, which gradually disappeared. . . . One of the greatest objections was the feeling that the arc-welded structure would be inferior because it would be difficult to take apart. The answer was that few machines ever did require disassembly, and that whenever this was necessary acetylene burning of the joints allowed faster dismantling than with rivets. Further, in case of accident repairs could always be made in the old manner or by welding. Fundamentally the structure was better, and when wood was used in combination the elimination of bolt holes in the wood increased the strength, allowing free expansion and contraction, and the steel binding prevented damage to the wood.

Welding Saved the Day

"In the case of racks great reductions of weight were attained as well as simplification of erection. On barrel storage racks a 40 per cent saving in weight was accomplished without loss of strength. In one case where we developed a machine for installing a refrigerating unit in a cabinet the specifications required the maximum weight of the machine to be 100 lb. and the lifting capacity 400 lb. This machine is made entirely of standard structural steel parts with one pressed-steel bracket for the lifting mechanism. This machine would positively be impossible to build to suit the conditions without arc welding. . . . In one case an all arc-welded steel truck of 30,000 lb. capacity was built for transporting heavy dies in an automobile plant. Not a bolt was used in its construction. . . . We also find that experimental work of all kinds is expedited by arc welding.

"I would like to caution any one who intends to produce articles by arc welding to be sure of two things: (1) That the operator be capable, skillful and experienced, as poor welding is bound to fail, and (2) that proper analysis of the joint be made beforehand by men experienced in arc-welding design and construction, for even if the weld is a good one and the design is poor failure will ultimately result."

Selling Ornamental Street Lighting

Inclusion of investment cost makes rates seem high. Municipality may own installation which is served by the utility company. Maintenance is a contractual arrangement

By R. J. Malcomson

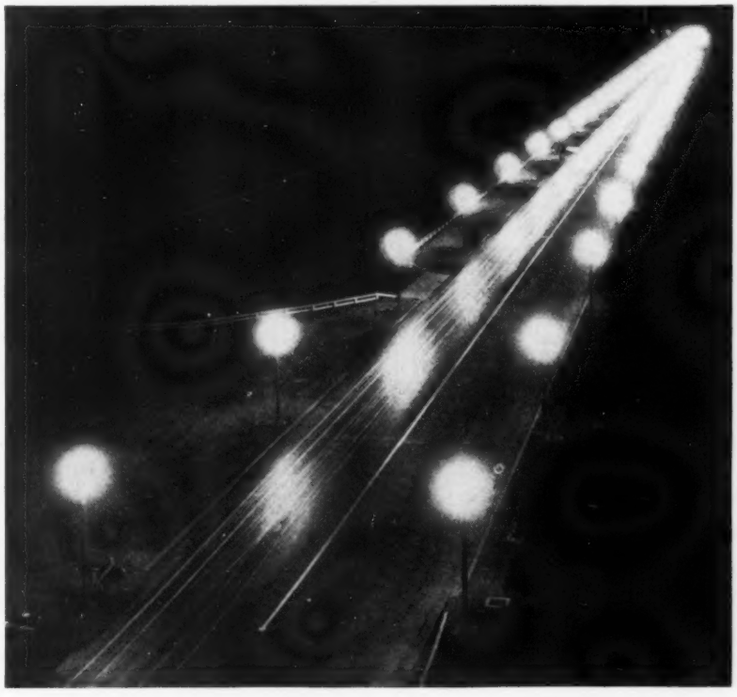
Public Service Company of Northern Illinois, Chicago

THE rapid growth of high intensity and ornamental street lighting in American cities has been a most striking manifestation of the acceptance of new ideas based on civic consciousness and civic pride. Citizens are quickly realizing that a city or village, good looking by night as well as by day, is a distinct business and social asset. However, it not infrequently happens that the cost of an ornamental system expressed in a single rate which includes investment charges as well as energy and maintenance is such as to make a community hesitate about undertaking monthly payments necessarily comparatively high. Most municipalities are firmly committed to the theory of amortization of bond issues, and the continuing investment represented in the rate for a utility-owned ornamental street lighting system is not altogether sympathetically regarded.

In order to get around this situation it is the practice of the Public Service Company of Northern Illinois, whenever possible, to eliminate the investment charge from the rate. This is done by permitting, or rather persuading, the municipality to own the ornamental system. It will be paid for by abutting property owners or by bond issue and it may be as elaborate or as simple as is desired. The municipality then knows exactly what it is getting and paying for and may discharge the incurred indebtedness in any manner it wishes. The investment thus disappears forever from consideration in the rate and is not, as is sometimes the case, a continual subject for bickering and argument. The smaller rate thus made possible, covering only the costs of current and service, is much less liable to misunderstanding or misrepresentation by those who scrutinize municipal expenditures and who are accustomed to consider central-station rates with respect to energy consumption only.

To care for that class of business in which the street lighting installation is owned by the municipality the company has a special form of contract. By the terms of this contract the municipality agrees to install the street lighting system at its own expense and in accordance with specifications approved by the company. The municipality may agree to maintain the system in good operating condition and to make all necessary repairs and replacements at its own expense, or it may enter into a maintenance contract with the utility by which it pays a flat amount per lamp per year. In either case it is the duty of the company without expense to the municipality to patrol the system, wind time clocks, clean glassware, furnish renewals, replace burned-out or otherwise defective lamps, and perform other incidental maintenance work. This contract may coexist with the standard contract of the company by which it owns and operates the ordinary utilitarian street lighting system if there is one in the community.

Type of billboard poster used to encourage boulevard lighting



There are 600 1,000-cp. lamps on McCormick Boulevard, running north out of Chicago

In 1923, when the lighting sales department of the company was organized, surprisingly few cities, towns or villages in its territory could boast of street lighting systems with underground distribution and a decorative post and lighting unit. In 1928 the company had 60 contracts for such systems. The largest of these systems includes over 4,000 lamps, the smallest of which is 250 cp. Another system, that of Berwyn, comprises 3,000 lamps, of which 87 are 1,000 cp. Another has approximately 2,000 lamps installed. There is another 4,000-unit installation pending, several of the lamps in which are 1,000 cp. Another installation on which the department co-operated passes through a number of

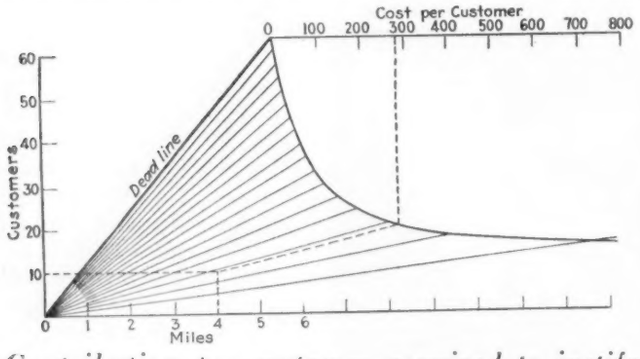
municipalities north of Chicago and includes 600 1,000-cp. lamps. This is a remarkable record of public acceptance of high-intensity decorative street lighting.

Parallel with this remarkable development is the development of public confidence in the company. When street lighting systems are under advisement or consideration by a municipal board it is the usual thing for these municipal officials to call upon the company for suggestions or recommendations. The value of this contact cannot be counted in money, but the good public relations and the confidence of the municipal officials are of inestimable value. The company makes no attempt whatever to sell equipment or cable or to bid for the installation contract. Illuminating engineering service is extended to contractors and engineers who are intrusted with the planning and installation of street lighting systems.

Contrary to experience in the past, the company now finds that the value of street lighting does not have to be sold. It is in general public demand. The practice of the company today is to give competent advice and recommendation to municipal officials to insure their getting the best available system and with provisions for adequate expansion and improvement as our standards of living and lighting are raised.

Chart Shows Rural Line Costs per Farmer

THE Public Electric Light Company, St. Albans, has figured that it can appropriate $75 per customer toward each mile of single-phase, 2,300-volt rural line. This figure is based on a line costing $900 per mile, assuming twelve customers per mile, with amortization of the investment in five years plus interest and taxes. To ascertain how much each customer must contribute where there are less than twelve per mile the company determines the difference between the estimated cost of construction and the afforded outlay or estimated revenue, divided by the number of customers. The accompanying chart, presented at a recent meeting of the Vermont Electrical Association by Maynard Foster, shows the contribution required per customer for extensions of various lengths and varying numbers of customers. The average farm customer on this system, of which there are 216, consumes 233 kw.-hr. per year and has a monthly bill of $1.97. Western red cedar poles 30 ft. long with treated butts are used.



Contribution per customer required to justify rural extensions on Public Electric Light Company

For example, ten farmers desiring service on a 4-mile line would have to pay $285 each in order to secure service at the company's regular rates.

Letters from Our Readers

More Observations on Dancing Cables

To the Editor of the ELECTRICAL WORLD:

I have read with interest the article entitled "Dancing Cables Affect Service" in the January 26 issue of the ELECTRICAL WORLD. I observed this characteristic while working in the Northwest about 1913. It was particularly noticeable on a wood pole line of short spans carrying 300,000 to 500,000-circ.mil cables.

It was my conclusion that the dancing was caused by unequal wind pressures along the line, which started the poles swaying transverse to the line in step with the swinging of the cables.

Later, as the wind pressure changed, the cables in adjacent spans would swing in opposite directions and all sorts of oscillations take place. Ultimately, however, the poles would begin a rotary type of motion, resulting in tension of the cables on one side of the pole and relaxing tension on those on the other side of the pole.

This effect, combined with the wind pressure, gave rise to an elliptical motion of the cable and elliptical or rotary motion of the pole top. The heavier the cables and the lighter the pole structure the more noticeable was the dancing effect. Those lines which were more rigidly supported than the others had less dancing, although the cross sway of the cables might be equal in each case.

It was my opinion that stiffening of the supporting structures at intervals would materially reduce the resulting vertical oscillation of the cables, particularly if the stiffening is in the direction of the line. It does not seem to me that every structure should be rigid as wind pressures are more or less constant over considerable latitudes.

A. G. DARLING,
Industrial Engineering Department.
General Electric Company,
Schenectady.

State Regulation Best*

BY FRANK D. COMERFORD
President New England Power Association

"I FAVOR adequate regulation by the public utilities commissions of the activities of gas and electric companies. If the state commissions need more power to regulate adequately, the Legislature should give them such power. Because so many electric companies are engaged in interstate business the jurisdiction of the local commissions as at present constituted may not be sufficient to regulate adequately. If this is so Congress should adopt the suggestion made some time ago, viz., delegate to the local commissions the federal powers of regulation so that matters arising could be handled by a joint commission composed of the commissions on each side of the state lines concerned. This would be preferable to having a body in Washington similar to the Interstate Commerce Commission regulating interstate power questions throughout the United States."

**Excerpt from address.*

Digest of Electrical Literature

Transmission, Substations and Distribution

The Influence of Glaze on Insulator Strength.—D. H. ROWLAND.—When the wet process porcelain insulator was originally developed it was only natural that its manufacture should follow the methods established by experienced potters. These workers, skilled as they were in the creation of useful pottery, were here faced with entirely new problems. Nothing was known of the inherent characteristics of electrical porcelain and even when such problems were tackled by mechanical engineers difficulties of a far-reaching nature were encountered. Some of the earlier work was very misleading in its character owing to unaccounted-for variables. Ordinary physical characteristics of porcelain, such as tensile strength, compressive strength, modulus of elasticity and coefficient of expansion, seemed almost impossible to arrive at. For a long time the tensile strength of good porcelain was supposed to be as low as 1,500 lb. per square inch. Tensile strength has since been determined as between 5,000 and 6,000 lb. per square inch on a cross-sectional area of 1 sq.in. It is the object of this article to present certain test data and to point out certain features in the mechanical design of porcelain resulting from this work.—*General Electric Review*, March, 1929.

Cooling of Transformers.—A. H. ALTMANN.—In an endeavor to increase the output of self-cooled transformers. European designers have now adopted radiator tanks, which have been used in America for nearly ten years. It is pointed out that plain corrugated tanks suffice for up to 8,000-kva. units, tubular tanks for a limit of 12,000 kva., while radiator tanks are economical up to 20,000 kva. If water is unavailable, the radiator tank offers the only alternative, regardless of output. To increase the effectiveness of such radiators, a forced air circulation around them or air jets against them have been used with good results. In such a case a double rating of the transformer is possible, as straight self-cooled unit and with the added air circulation. External and internal water cooling is described, which gives a smaller machine, provided the available water is clean and not expensive. Comparative costs are given for a 10,000-kva., 10-kv. transformer, equipped with any one of the four customary cooling methods. *Elektrotechnik und Maschinenbau*, February 10, 1929.

Calculation of Air-Core Reactors.—J. HAK.—Many investigators of this subject have developed in past years mathematical formulas for the inductivity of a great many shapes of coils, such as are used for reactors with an air core. These exceedingly precise formulas are, however, only then applicable if the particular shape of coil which the designer finds necessary for his case coincides with any one of the available types. If this is not the case, interpolation or extrapolation has to be resorted to, with resulting questionable accuracy. If time permits, a new formula may be developed by integrating the double integral, which expresses the mutual inductance of two coaxial circuits over the entire winding space. To avoid this cumbersome method, the author presents new curve sheets for circular coils of rectangular winding space. Similar curves are given for the most economic ratio of copper weight to inductance, for mutual inductance of coils and for mechanical forces between coaxial coils. On eight examples the proper interpretation of the curve sheets is explained. — *Elektrotechnische Zeitschrift*, February 7, 1929.

Metals for Line Conductors.—WILLIAM T. TAYLOR.—For a 220-kv. transmission line it is customary to consider a conductor of 1.0 in. over all diameter. In England they have already settled on a diameter of a little over 0.75 in. over all for the 132-kv. national "grid." Of the different commercial metals to use for these types of overhead electric power lines we may select several that can at the present time be classed as the best conductor materials. These are copper, cadmium copper, copper or cadmium copper for the conducting part of the strand and aluminum-bronze for reinforcing where additional strength is required, aluminum for the conducting part of the strand and the galvanized steel for reinforcing where additional strength is required, copper-weld copper and aluminum bronze. A number of tables show the relative electrical properties of cables of the various materials mentioned. — *Electrician (England)*, March 8, 1929.

Generation, Control, Switching and Protection

Recent Developments in Turbo-Generators.—J. A. KUYSER.—The recent developments in turbo-generators dealing with ventilation, including radial, axial, radial-axial and multiple-inlet systems, also internal and external fans. The elimination of eddy currents is next considered, the various methods past and present being reviewed. These include: Twisted and transposed windings; twisted and transposed slot conductors; twisting and transposition of end connections; combination of transposed slot conductors and end connections. The magnetic field of stator end connections is dealth with, as is the local heating produced in the core, stator end plate and stator end connections. Vibration of conductors, swelling of insulation, smooth core design, expansion and contraction of armature conductors, crinkling of insulation, bakelized conductors and clamping of stator winding are given their place, along with many other points of interest. —*Report of the Institution of Electrical Engineers*, March, 1929.

Direct Generation of Alternating Current at High Voltages.—CHARLES A. PARSONS and J. ROSEN.—The use of high-voltage alternators and the partial abolition of transformers. In support of these proposals, the gradual growth of conditions favorable to the introduction of the high-voltage alternator and the obstacles in the way of further development at lower voltages are discussed. As a matter of interest to those engineers and designers engaged in alternator construction and development an outline is given of some of the experimental research carried on by the authors in the working out of the practical details of new design and of the tests made at work on the completed alternator.—*Report of the Institution of Electrical Engineers*, March, 1929.

Hydro-Electric Development and Steam Equipment

Exhaust from Two 1,300-Lb. Turbines Will Operate Lakeside's New 60,000-Kw. Unit.—The new 60,000-kw. turbo-generator recently installed in the Lakeside plant of the Milwaukee Electric Railway & Light Company takes its place among the largest single-cylinder complete-expansion turbines thus far constructed. It is the first of the size and type made by the Westinghouse Electric & Manufacturing Company. Its construction and principal features are the use of the impeller-type oil governor in the place of the mechanical flyball type, the use of a new type of fastening in the last three rows of reaction blading, the single-anchor method of supporting the cylinder and the provisions for insuring easy starting.—*Power*, March 19, 1929.

The High-Pressure Steam-Electric Plant of the Witkowitz Collieries, Czechoslovakia. — JAROSLAV HAVLICEK. —In studying the various types of steam generators available for this installation the following questions arose and were decided: Whether the heat transmission from tubes to saturated and superheated high-pressure steam was sufficiently great to secure, with moderate heating surfaces, a supply of steam without the necessity of having too great a difference in temperature between the tube walls and the steam; whether the rate at which the superheated steam gives up its heat to the water during its flow through the latter is sufficiently rapid, and whether it is possible to generate as much steam per unit of water surface as in the older types of

heavy-duty boilers; whether the capacities of the feed-water pump and the circulating pump required for circulating the steam in the boiler system are not too great; whether the design of the circulating pump is such as to assure continuous operation over a long period; whether the pipe coils in the boiler drum can be made of ordinary, inexpensive material; whether the autogenous welding of the tubes is dependable, and whether the flanges will remain thoroughly tight for a long time. —*Mechanical Engineering,* April, 1929.

A Hydro-Electric Project.—F. E. FULLERTON.—Representing an outlay of $7,250,000, the construction of another hydro-electric station on the Stave River at Ruskin, near Vancouver, is to be started. Completion of the first unit, which will develop 43,000 hp., by means of one generator is expected by the end of 1930. Foundations will be laid for another generator of the same size which can be put in at any time and eventually the plant may develop 720,000 hp. The dam will be of concrete with a maximum height of 183 ft. and a length of 325 ft. at the crest.—*Electrical Review (England),* March 15, 1929.

Units, Measurements and Instruments

Bushing Type Current Transformers for Metering.—A. BOYAJIAN and W. F. SKEATS.—A description of a new development in connection with bushing type current-transformer metering circuits. While this development utilizes the two-stage principle and has the same order of accuracy as that of two-stage current transformers, it is different from the conventional two-stage current transformers in that it does not require two-stage wattmeters and watt-hour meters, but may be used with any wattmeter or watt-hour meter. The principle and connections of the transformer are explained and performance curves of a typical unit are given.—*Paper presented before the A.I.E.E., Cincinnati,* March 20-22, 1929.

Approximate Three-Phase Power Measurements.—G. W. STUBBINGS.—For the measurement of the power input to three-phase induction motors with balanced loads, either for the purpose of allocating cost or in the course of routine industrial testing, great accuracy is not essential, and the approximate methods involving the use of one instrument only have the merit of cheapness and simplicity, while giving results sufficiently near the truth for the purpose required. — *Electricity (England),* February 28, 1929.

Iron Losses in Turbo-Generators. — C. M. LAFFOON and J. F. CALVERT.—In large turbo-generators there is no convenient method for determining the iron losses under load. It is the purpose of this paper to show analytically the factors influencing the change in iron loss with load. While very definite results are given for a simplified machine, it is not recommended at this time that any change be made in the standards for computing load loss because there is much to be done before the work can be considered complete. This particular problem is typical of many which are entirely suitable for purely analytical study and should furnish very desirable work for investigators who do not have access to large machines for extensive tests but who desire to carry on studies related to this type of apparatus. This as well as similar loss problems can be studied much more readily by theoretical work and model tests than from measuring the total losses of an entire machine, because the value sought is never a predominant proportion of the total value measured, and even if satisfactory results be obtained on a particular machine they are not generally applicable to all such apparatus. — *Report American Institute of Electrical Engineers,* March, 1929.

Heat Applications and Material Handling

Automatic Arc-Welding Machines.—F. NIETHAMMER.—The signal success of arc welding caused such a wide application of it that mechanical means had to be devised wherever possible to do the work of welders. This led to the development of automatic welding machines, which perform the work more quickly, more uniformly and at less expense. In a detailed article, with 35 illustrations, the author gives descriptions of European and American types, adapted for a variety of special applications, such as tire welders, barrel welders, pipe welders, railroad tie welders, straight and curved seam welders and welders for fabricated machine parts. All of them use the direct-current arc. It is pointed out that, due to the greatly reduced labor costs, the possible short deliveries, savings in weight and greater reliability, automatic welding has not only revolutionized modern machine design, but is actually of prime national economical importance.—*Zeitschrift des Vereines Deutscher Ingenieure,* February 16, 1929.

Traction

Automatic Mercury-Vapor Rectifier Substations in Chicago.—A. M. GARRETT. — The two automatic mercury-vapor rectifier substations having 3,000-kw., 5,000-amp., 600-volt rectifiers are described in this paper. These rectifiers are the largest installed in this country. The reasons for the selection of this type of converting equipment instead of the rotary converter are enumerated. Information is given on the auxiliary apparatus and control equipment. — *Report American Institute of Electrical Engineers,* March, 1929.

Street Railway Power Economics on the Cincinnati System. — J. A. NOERTKER.—The system now consists of nineteen full automatic synchronous converter substations upon which has been superimposed a complete system of supervisory control and remote metering. This paper discusses the economic factors involved in the selection of equipment and the design of the system. —*Report American Institute of Electrical Engineers,* March, 1929.

Miscellaneous

The Off-peak Heating Load.—L. G. A. SIMS.—In a contribution on this subject some time ago the advanced stage of development in Switzerland and the wide and increasing use of apparatus devised to allow the storage and subsequent use of electrical energy in the form of heat were described. It was shown, for instance, that by applying the principle to the heating of water, and to a less degree to the heating of buildings, the load factor of one Swiss town was increased between the years 1915 and 1924 from 56 per cent to 74 per cent, and it was stated that the increased revenue and the wonderful characteristics of a load which can be fitted easily by the supply authority into the off-peak hours were so great that Swiss authorities, without exception, were giving every possible encouragement to its growth. It is, therefore, surprising to find that despite the acknowledged benefits to both supply authority and consumer there is still little progress along these lines. There are at present in England three supply authorities which offer an attractive tariff for this type of load. — *Electrical Review (England),* March 1, 1929.

Alignment Costs Chart.—W. A. BARCLAY.—When an electricity supply authority has alternative methods of charging for current consumed, the question as to which method is preferable arises. In order to compare the costs of two rates, an alignment chart was prepared of four elements, the two center scales showing units of heating and lighting used. If a straight line be placed across these scales at the particular values of the units consumed it will meet the third or left-hand scale at the cost at ordinary rate, while it will also meet the fourth or right-hand scale at the balance of cost at the special rate, giving at one printing the two readings and allowing of the selection of the more desirable one. — *Electrician (England),* March 1, 1929.

Electrical Equipment of the Singapore Floating Dock.—ERNEST T. WILLIAMS.—An account of the electrical equipment of the Singapore floating dock. The dock is now complete and is said to be one of the largest in the world and was built in an exceedingly short time. The electrical equipment includes: A 1,000-volt, three-phase system for main generation and pumping, a 220-volt, two-wire d.c. system for auxiliary generation, lighting and power, a 20-volt, two-wire d.c. system for control of dock operations and a complete telephone system with central exchange, provision for supplying submarines in dock with electrical energy for lighting and power and for supplying submarines in dock with electrical energy for charging the large storage batteries.—*Institution of Electrical Engineers (England),* March, 1929.

Book Reviews

Electric Lines and Nets

Their Theory and Electrical Behavior. By A. E. Kennelly. New York: McGraw-Hill Book Company, Inc. Second edition, 426 pages, illustrated.

Several years ago Dr. Kennelly made a distinct contribution to electrical work by the use of new conceptions of electrical circuits whereby the mathematical solution was simplified and expedited. Much of this work was published in 1917 in his book "Artificial Electric Lines." The present book is a revised and enlarged edition of the early work and covers the fundamentals of all electric circuits. The equivalent *T* and Π structures are used freely in circuit solutions and fundamental terms and definitions are given to build up to the solution of complicated network problems.

All kinds of lines are discussed, including quarter and half wave length lines, lumped and distributed lines and networks of lines. Very welcome chapters deal with composite lines, electric networks in a steady state and the use of lines as frequency filters. The book includes fundamental mathematical treatments of trigonometric properties, differential equation applications, the use of symbolic methods and the use of substitute or equivalent circuits and impedances.

Principles of Radio Communication

By J. H. Morecroft. Second edition. New York: John Wiley & Sons. 998 pages, 64 illustrations.

As the author points out, the information on radio subjects has become so plentiful that it is impossible to cover all of it even in brief form in a single volume, so only the more pertinent phases are answered in this second edition and references given to other more complete works. Still the size of this volume has been increased.

Among notable additions to the first edition are the portions of four different chapters giving data on coils and condensers at radio frequencies, general features of radio transmission, new material on field strength measurements, reflection and absorption, fading, short-wave propagation, voice analysis, the performance of loud-speaking telephones, frequency control and distortionless amplification, including radio-frequency amplification, balance circuits and push-pull arrangements.

The same situation is arising in radio that has long existed in most textbooks on electrophysics—so much information is available that to cover the subject either very unwieldy volumes or several volumes must be presented or the material must be condensed to the point that it becomes general. Authors would be serving the needs of readers more if they omitted or only briefly summarized information which has been well presented before (giving references) and devoted the majority of text illustrations and data to the newer data.

Considering radio telephony, for example, readers want to know what new information is available on wave propagation, conditions that increase range of static, and particularly how the entry of socket-power operation has affected characteristics of tubes, requirements of eliminators, etc. Quality reception has become such a demand that a book might well be devoted to production of quality reception, whether it involves tubes, circuits, transformers or loud speakers. In general, the subject of radio is becoming so large that there is need for books on different phases of the subject rather than a single volume attempting to cover the whole field.

Hydraulic Laboratory Practice

Edited by John R. Freeman. New York. Published by the American Society of Mechanical Engineers. Baltimore, Md.: The Lord Baltimore Press. 841 pages, illustrated. Price, $10.

A valuable guide to those interested in hydraulic problems embodying river flow and the actions of rivers in normal or changed conditions, these changes being the change of river beds by bridges, piers, etc. A record of what has been accomplished both in Europe and in this country in hydraulic laboratory research. Descriptions of various hydraulic laboratories in Europe and in this country, with detailed drawings, photographs and curves. This book should be of assistance to those interested in the construction of dams and spillways, the improvement of harbors and waterways, the protection of coast lines and the development of water power. Great losses of time and money might be saved by the use of two-scale model experiments in hydraulic laboratories before actual installations are made. This book should be an excellent guide for any such hydraulic laboratory work.

Wasserkraft, Elektrizität

By Prof. K. von der Ax and Dr. E. Fabian. Leipzig: B. G. Teubner. Chart, 28x40 in., on heavy paper or on papyrolin with rods.

The simplest way to indicate the scope and usefulness of this chart, one of a series on world economics, is to describe it. The reputation of the publisher is sufficient guarantee as to its execution. It consists of a map of the world on Mercator's projection, outlining the countries. Surcharged, in colors, are areas representing, to scale, installed kilowatts, per cent of electrical energy generated from water power and horsepower of developed streams. Marginal diagrams show, by countries, their proportionate share of the world's developed water power and the energy generated per capita in 1925. The actual figures are tabulated.

The compilation inevitably suffers from the limitations of the basic statistics, such as differences among countries in computing potential water power and in reporting, variously, total energy generated or only the outputs of public utility plants. This is no criticism of the work of the compilers. They have effectively presented available data, of interest to publicists, financial houses and engineers dealing with the broader problems.

Book Notes

GOVERNMENT (POLITICAL) OWNERSHIP AND OPERATION AND THE ELECTRIC LIGHT AND POWER INDUSTRY. New York: National Electric Light Association. 530 pages.

This book, issued by the N.E.L.A. through its department of public information, was prepared primarily for the information of member companies of the association, but probably will receive much wider distribution, since it makes available in one place an imposing array of facts, statements, views of leaders of thought and arguments showing the trend away from political ownership and operation. The first 154 pages are devoted to a history of political ownership and operation, to salient data on the extent and trend of municipal operation and to quotations from authoritative expressions of opinion on the relation of government to business. The remainder of the book contains a detailed list, by states, of municipalities that have abandoned, sold or leased their electric plants to private companies; 1,412 cities and towns are named.

INDUSTRIAL EXPLORERS. By Maurice Holland. New York: Harper & Brothers. 347 pages, illustrated. Price, $3.

This series of essays on modern developments in industry through the application of science is written by an enthusiastic and well-informed man. Dr. Holland, in his connection with the National Research Council, has come into intimate contact with the romance of science and has drawn upon his contacts to write these illuminating essays. Each essay deals with a noted engineering or research worker and his discoveries and the author accents the human as well as the technical features of these men. The book should be interesting and informative to the public as well as to the scientific groups.

Books Received

The New Industrial Revolution and Wages. By W. Jett Lauck. New York: Funk & Wagnalls. 317 pages. Price, $2.50.

Radio Receiving Tubes. By James A. Moyer and John F. Wostrel. New York: McGraw-Hill Book Company. 297 pages, illustrated. Price, $2.50.

Operational Circuit Analysis. By Vannevar Bush. New York: John Wiley & Sons, Inc. 392 pages, illustrated. Price, $4.50.

Maste und Turme in Stahl. By P. Sturzenegger. Berlin: Wilhelm Ernst & Sohn. 219 pages, illustrated.

The Blue Book, 1929. London, England: Ernest Benn, Ltd. 1482 pages. Price, 25 shillings, net.

Standard Wiring for Electric Light and Power. By H. Cushing, New York. 504 pages.

News of the Industry

Good Meeting at Tucson

Ancient Arizona City Hears Up-to-Date Addresses and Papers When State Utilities Men and Pacific Coast Electrical Association Meet

PERHAPS the most colorful and successful utilities meeting ever held in Arizona, both in point of attendance and in actual work accomplished during the three-day sessions, was the fourth annual convention of the Arizona Utilities Association, which met jointly with the Pacific Coast Electrical Association and the Pacific Coast Gas Association on April 4, 5 and 6 at the new El Conquistador Hotel in the ancient city of Tucson.

M. A. Pooler of Tucson, retiring president of the association, in opening the convention, outlined the growth of Arizona and the progress and development of the utilities within the state, with particular emphasis on the Tucson Gas, Electric Light & Power Company, of which he is president. The principal address of the opening day was made by Paul M. Downing of San Francisco, president of the Pacific Coast Electrical Association, who declared that the utilities need fear nothing from investigations and implications of wrongdoing if they will inform the public of their work and accomplishments in a fair and impartial manner.

Important papers included one by E. B. Chase, National Lamp Works, San Francisco, on "Light, the Business Getter," illustrated with explanatory charts. A. E. Higgins, American Gas Association, outlined ways in which to educate the public in the choice of lighting equipment. George Lewis of Denver, representing the Rocky Mountain Committee on Public Utility Information, gave an interesting address, using as his subject, "Still Again, Why All the Secrecy?" He appealed to those present, when they returned to their respective companies, to pass on to others some of the things they had heard and learned by attendance at the convention.

On the second day excellent papers were read by company employees as follows, first, second and third prizes being awarded respectively to the three named: "Employees and Customers' Relations," by Wilma D. Jones and Irene Wolcott of Bisbee, representing the Arizona Edison Company; "Better Public Relations Through Association Work," by Claud H. Weber, Tucson Gas, Electric Light & Power Company; "Telling the Story," by Jack Arnold of the Central Arizona Light and Power Company, Phoenix. "Feminism in the Public Utility Field" was dealt with by Mrs. Ruth E. Creveling, San Diego, chairman women's committee, Public Relations Section, Pacific Coast Electrical Association.

Election of officers for the following year and reports of committees, as well as the annual report of Lee C. McCullough, secretary and treasurer of the association, occupied the last morning. This business session was followed by a trip to the famous cattle ranch on the Mexican border, 60 miles south of Tucson, known as the Hacienda de la Arivaca, where a specially prepared entertainment and a barbecue were given.

New officers are: President, L. V. Seares, Arizona Power Company, Prescott; first vice-president, A. F. Morairty, Central Arizona Light & Power Company, Phoenix; second vice-president, Milton G. Sanders, Arizona Edison Company, Phoenix; secretary-treasurer (re-elected), Lee C. McCullough, secretary Arizona Industrial Congress, Phoenix.

New York Submetering Hearings Put Off Till Fall

Announcement has been made by the New York Public Service Commission that it has granted a request to postpone all further hearings in the matter of submetering until the early fall. It was explained that the illness of William L. Ransom, counsel for the Edison companies, and important engagements of other counsel had caused the request for the postponement.

The submetering issue came before the New York commission last December when seven cases involving the Brooklyn Edison Company, the New York & Queens Electric Light & Power Company and the Bronx Gas & Electric Company were brought up for adjudication after the Survel Realty Company of Brooklyn had obtained a court order restraining the Brooklyn Edison Company from removing a master meter in an apartment house owned by the complainant until the question at issue should be decided by the commission. It was at once made clear that, reversing the former policy of the New York Edison Company, the united metropolitan companies, under the leadership of President M. S. Sloan, would fight vigorously for an order prohibiting submetering. To this policy the real estate owners and submetering companies responded by engaging a phalanx of well-known attorneys and by threats of starting individual generating plants of their own if the case should go against them. The various hearings held by the commission have been briefly reported in the ELECTRICAL WORLD.

An attempt by the advocates of submetering to bring into the hearings the whole question of rates and make it a part of the proceedings met with the disapproval of the commission. So far as regards the New York Edison Company, rate proceedings, instituted when John F. Hylan was Mayor, have been slowly proceeding for years, great masses of testimony on valuation being collected. As to submetering, it is predicted that no matter what the commission's decision may be, the issue will be taken to the courts, where a long legal fight may ensue.

What Trade Commission Asks of Bond & Share

Allocation of Fees Paid by Operating Companies Is Not Indicated in Sufficient Detail in Expense Summaries Submitted, Judge Healy Says

"THERE is no fishing expedition here," Robert E. Healy, chief counsel for the Federal Trade Commission, says in a reply brief recently filed in the New York court action against the Electric Bond & Share Company. Judge Healy denies that his organization seeks to rummage the company's files in hope of finding something discreditable. The commission is simply following a direct order from the Senate, he declares.

Answering the company's claim that the yielding of operating and expense ledgers would reveal accounts to competitors and would disrupt the personnel by showing internal transactions, Mr. Healy's brief denies any thought of broadcasting these figures. These ledgers are understood to be an index to vouchers. It is intended to call only for such vouchers as are in line with the investigation. The argument goes on to establish the constitutional legality of this demand, pointing out that no attempt is being made to show whether the anti-trust laws are being violated.

The commission's purpose in demanding the ledgers, according to the brief, is to determine how fees paid by the operating companies are allocated. Such expense summaries as have been submitted are not in sufficient detail for this purpose. It is stated that the 2 per cent payments made by the operating companies to the Electric Bond & Share Company in return for services may be charged to operating expense by the companies, thus in many cases affecting the rates charged in interstate sale of power. The point is made that such allocation is improper.

Citing examples, the brief reads: "Preliminary investigation and engineering in connection with development should be charged to capital; financing expenses should be set up and amortized

or written off as surplus; legal charges in connection with construction should go to capital. The contracts on exhibit indicate other available services which should have similar allocation."

Present practices by the company are said to increase rates by the addition of charges which should be amortized over a period of years. According to Supreme Court rulings, state commissions and courts cannot ordinarily inquire into records which would expose these practices and show whether or not correction is necessary. Therefore, it is concluded, an investigation such as the Federal Trade Commission is conducting is in response to a definite need which otherwise could not be met.

City Club of New York on Light and Power Rates

In a pamphlet entitled "Electricity in the Home" the City Club of New York City attacks what it considers to be the inequity of the present system of regulation in the State of New York. The pamphlet includes a map of the state showing wide variation of rates in different sections served by nine holding companies, ranging from 4½ cents per kilowatt-hour in the Niagara district up to more than 20 cents in other parts of the state. The pamphlet charges that consumers are required to pay for energy, not on a basis of cost of production but upon an arbitrary judgment of what the public will "stand for." Inflated valuations, intercompany contracts, stock manipulation and other devices employed by the companies, the pamphlet says, have served to keep rates up to a high point compared with any state in the Union. The greatest exploitation is held to be in New York City.

The veto by Governor Roosevelt of the bill passed by the Legislature to create a nine-membered commission to investigate the operation of the Public Service Commission law is urged by the City Club on the ground that such a commission would prove cumbersome and unfitted to its task.

Central Maine Power Company Expanding Fast

Vigorous expansion is the program of the Central Maine Power Company for 1929, according to a letter sent to stockholders April 1 by President Walter S. Wyman. The year recently closed was about the best in the company's history. The output of the Golf Island development has been sold on a scale already supporting the five-million-dollar investment involved, and about 500 men are now employed on the 100,000-hp. Bingham development on the Kennebec River, which will continue for two or three years. When completed, this project will place at the disposal of the company nearly as much energy as it is now generating plus two-thirds of the energy output of the Cumberland County company of Portland, affiliated, as is the Central Maine, with the National Electric Power Company.

The Central Maine company has been instrumental in putting several industrial concerns on their feet within recent months and is negotiating with new industries in regard to locations. Rural extensions are being pushed actively, and the company has energetically supported the Smith-Carleton bill, which will permit limited export of power from the state.

In the States' Legislative Mills

Maine Legislature Passes Water-Power Export Bill with Provision for Excise Tax—New Bill for Survey in Minnesota—Oklahoma Defeats All Anti-Utility Measures

PASSAGE by the Maine Legislature of the bill permitting exportation of surplus hydro-electric power is the most important item of legislative news this week. It had been accepted by the Senate, and the concurrence of the House, where the contest has been close, was insured when the consent of the promoters of the measure to an amendment imposing an excise tax on the exported energy was given. In many of the states the session is over or nearly so, though the Florida Legislature has just assembled and Texas is to indulge in an extra session.

CALIFORNIA.—The Legislature has had before it a proposal for a comprehensive development of the state's water resources which would include the proposed Colorado River aqueduct for the benefit of southern California cities and the projected Kennett Dam on the Sacramento River. A bond issue of $300,000,000 or more is involved. It is maintained by some advocates of the plan that enough power could be generated at the Kennett Dam not only to repay the cost of the Sacramento River works but to go far toward meeting the charges on the bond issue. Opponents point out that, even assuming this to be true, there is no warrant for making the non-remunerative undertakings a burden on districts they do not benefit, and that grouping a number of local or regional projects together does not invest them with a state interest.

INDIANA.—Business gains for Indiana utility companies as well as other businesses are expected to flow from the new corporation code enacted by the Legislature, now adjourned, and signed by the Governor. The rate for incorporation has been cut to one-tenth the sum under old laws, and the new code removes many hampering conditions hitherto imposed on Indiana corporations. Administration of the new law will be under the direction of the Secretary of State. The bill is the result of extensive work by a special commission named two years ago.

IOWA.—The Senate sifting committee last week reported out a substitute for the maximum-rate bill for public utilities. The original bill provided that cities and towns operating municipal plants shall fix minimum instead of maximum rates for competing public utilities, while the sifting committee proposal aims to make it impossible for privately owned electric plants to make unprofitable rates with large consumers in an endeavor to prevent municipal competition.

MAINE.—The long and bitterly fought issue of water-power exportation has apparently come to an end in Maine with the passage by the Legislature of the Carleton, or Smith-Carleton, bill to permit this disposition of surplus energy. The bill is subject to a referendum in the fall, but an amendment adopted at the eleventh hour by the legislators which imposes a 4 per cent excise tax on the gross revenue from the sale of surplus power is thought to have made effectual opposition to the law extremely improbable. This amendment had been opposed by the power companies. When they withdrew their opposition to it the bill passed the Lower House by a large majority, though previously an "ought-to-pass" report from the joint water-power committee of the Legislature had been accepted only by the close vote of 73 to 69. The bill had already passed the Senate in its former shape. The main provisions were printed in the ELECTRICAL WORLD for March 23 (page 603). The Governor will undoubtedly sign it.

Both House and Senate have passed a bill to incorporate the Fish River Power & Storage Company, a subsidiary of the International Paper Company, and permit the company to act as a public utility, to generate electricity and create and maintain storage basins in the Fish River section of Aroostook County. A bitter fight was waged over this bill in the House, one opponent charging that the paper company wanted the right to dam the Fish River chain of lakes and regulate the flow of water for the benefit of its generating plant at Grand Falls, New Brunswick.

The bill to tax all radio sets $1 annually has been killed.

MINNESOTA.—No more bills can be introduced in the Legislature, which closes April 25, unless consent is obtained from the Governor. While a sub-committee of the Senate was working on consolidation of three bills proposed for regulation of water power, Representative George Rodenberg of St. Paul introduced a bill in the House providing that, following the enactment of immediately proposed legislation, an interim committee should be

appointed to survey the entire situation. The interim committee would be composed of five members of the House, five of the Senate, one member appointed by the Governor, and the Speaker of the House and President of the Senate as ex-officio members. It would be charged with making a complete survey in the next two years of electric utilities in Minnesota, including the water-power companies now operating and the water-power sites still undeveloped. It would in its report also make recommendations as to proper laws to govern and regulate such public utilities as produce electric light, heat and power.

Of the three bills before the Senate the Lightner bill goes farther than the others and gives the Railroad and Warehouse Commission power to regulate all electric rates where light or power is produced by water power. The two other bills omit this provision but give the state authority to require all power companies to obtain permits for any present or future location of a power site. They also require consent of the state conservation commission to any change in water levels sought by power companies.

A bill has been introduced which would authorize towns to contract with villages or cities for electric light and power and to construct necessary pole lines.

MISSOURI.—The House has killed a bill presented by Representative Whitaker of Hickory County which provided that the Missouri Public Service Commission could not fix a minimum rate for any public utility nor interfere with any such utility making as low a charge for its service as it desired. Opponents of the bill contended that it would permit competing utilities to engage in rate wars that would not net the companies a fair return on their investments and cause unfair discrimination in favor of certain localities or customers.

NEBRASKA.—The Senate has recommended for passage the bill allowing municipal plants to operate within a 25-mile limit, amended so that the municipal plant may pay the cost of extension and maintenance out of net future earnings for a period not to exceed three years. Any additional sum must come from expenditures approved by at least 60 per cent of the qualified electors. As an alternative, cities and villages may issue bonds in any sum necessary or desirable.

The House passed without opposition a bill asked for by Governor Weaver which appropriates $525,000 for a combination lighting, power and heating plant for the State University and the State Capitol. The Capitol is now lighted by the state penitentiary plant, 3 miles away.

OKLAHOMA.—The Legislature adjourned on March 30 without enacting into law any of the bills which might have handicapped the public utility industry. Only two bills affecting public utilities were passed by the Legislature, and these related to natural gas and to airports. A long list went down to defeat.

TEXAS.—The Legislature will meet again, in special session, on April 22. One of the subjects which Governor Dan Moody will again submit is the creation of a public utilities commission. A bill of this nature failed of passage at the recent regular session. Representative George C. Kemble of Fort Worth has the bill ready. It follows along general lines the orginal measure, but various objections raised have been eliminated. Municipally owned public utilities are exempt from the provisions of the bill. "My bill will be supported by the larger cities of the state," Mr. Kemble says. "The opposition will come from the public utilities, which are opposed to being regulated."

Northwest Engineers' Operating Problems

Alternating-Current Underground Networks, Rural Electrification, Getting Fish Over Dams and Radio Interference Among Subjects at Walla Walla, Wash.

GATHERED from all sections of the Pacific Northwest, 140 men interested in central-station engineering and operating problems met at Walla Walla, Wash., on March 25-27, for the annual group meeting of the Enginering Section, Northwest Electric Light and Power Association. Individual committee meetings gave way to general sessions at which papers were presented and discussed.

President R. M. Boykin of the association suggested the formation of a permanent power committee consisting of all committee chairmen to study problems which affect the Northwest as a whole, such as power needs, interconnection and economies and the interrupting capacity of oil circuit breakers. He further urged that utilities make a special effort to give employment to engineering graduates, but called the attention of educators to the shortcomings of many engineering graduates in speaking and writing English.

Several papers on alternating-current underground systems were presented. One by F. L. Rohrback described the ring-feeder system being installed in Spokane; another, by F. E. Fisher, took up the use of translators for partially converting the delta alternating-current underground distribution system in Seattle into a grid system, and a third, by H. Richter, Westinghouse Electric & Manufacturing Company, dealt with the broader engineering features of alternating-current underground distribution, including the use of network protectors and other recently developed apparatus.

Engineering of rural electrification was the subject of a paper presented by R. E. Gale for the overhead systems committee. Careful studies made by the Idaho Power Company have led that company to adopt as standard construction for rural lines 7-in., 35-ft. poles, 250-ft. spans, No. 6 hard-drawn wire and a voltage of 6,900/11,000. Such lines will serve a territory where there are an average of five customers per mile and a load of 15 kw. per square mile. The average cost per mile is $1,015.

Application of some of the more important requirements of the National Electrical Safety Code affecting overhead lines were presented in graphical form by R. J. Davidson. Dan L. Lindsley summed up the advantages of creosoted Douglas fir poles as strength, long life, non-conductivity and being fire-resistant and termite-proof. Major H. S. Bennion, director of engineering, N.E.L.A., explained the code situation. Discussion of a paper by A. L. Harding on preferred voltage standards for alternating-current systems showed clearly that operating men favor standardization, but that on most systems this involves many difficulties and great expense. Much interesting and valuable information was given in two papers on recent apparatus developments, one by C. E. Carey (Westinghouse), the other by C. W. Fick (General Electric).

The second afternoon of the meeting was given over to the accident-prevention and meter committees, each of which presented three papers of value to those interested in these fields.

That the fish problem in connection with hydro-electric developments is still a live issue in the Northwest was shown in a paper on this subject by J. E. Yates. He said that experiments with an electric fish screen have shown its practicability as a means of keeping small fish out of irrigation ditches and told of experiments under way to determine its value in diverting salmon into traps, hoists and fish ladders at the Gold Ray dam in southern Oregon, since if fish can be diverted into such devices there is no difficulty in getting them over high dams. Turbine leakage and problems of hydro-unit governing were the subjects of two other papers presented by the hydraulic power committee.

A paper on predrying of hog fuel (sawmill refuse), by W. A. Struthers, dealt with experiments on drying with flue gases hog fuel containing 46 per cent moisture. The tests indicated that from a heat-balance standpoint there was no economy over utilizing the heat in some other manner. However, the subject was said to be worth further investigation.

Two fine papers were presented by the inductive co-ordination committee—one, by Ellis Van Atta, dealing with radio interference caused by pin-type insulators; the other, by E. L. White, on interference caused by suspension insulators. Each paper presented a dis-

tinct contribution to the knowledge of the underlying causes of radio interference along transmission lines, outlined remedial methods and told of efforts being put forth by insulator manufacturers to aid in the solution of the problem. In order to expedite solution of the problem it is planned to build a 3,000-ft. experimental line at Oregon Agricultural College and conduct a comprehensive and exhaustive series of tests with all types of insulators and at the various standard transmission voltages.

Purchases and Mergers

Arizona Power Company Changes Hands—Mergers in Arkansas and Missouri Involve Sizable Properties —Offer for Radford (Va.) Plant

A SUBSTANTIAL controlling interest in the Arizona Power Company was sold on April 8 by F. E. Kingston & Company, Hartford, Conn., to the Commonwealth Utilities Corporation of St. Louis. It is understood that the Arizona company will be liquidated. It serves a population of about thirteen thousand, of which Prescott is the center, has 22,000 hp. in steam and hydro power, a total capitalization of $7,440,000 and assets put at $8,376,000.

Purchase by the Arkansas Power & Light Company of the Arkansas Public Service Company properties, a deal involving approximately $750,000, has been concluded, according to a dispatch from Pine Bluff, Ark. The sale includes the light, water and ice plants in Harrisburg, Lepanto, Ola, Danville, Berryville and Green Forest. The Arkansas Public Service Company is a subsidiary of the Central States Power & Light Corporation of Dubuque, Iowa.

The East Missouri Power & Light Company of Troy, Mo., and the Missouri Edison Company of Louisiana, Mo., owned and operated by A. H. Latimer and J. W. Peterson, have been merged. Both companies are now owned by the Inland Power & Light Company of Missouri, with headquarters in Chicago. The Missouri Edison has supplied light and power to Louisiana and other towns in Pike and Lincoln Counties, while the East Missouri Power & Light supplied Troy and 32 other towns in Lincoln, St. Charles, Warren and Montgomery Counties.

Purchase of the Erwin Light & Power Company of Erwin, Tenn., by Henry L. Doherty & Company of New York was announced April 6 by L. H. Phetteplace, general manager of the Erwin company. The deal involved $200,000 approximately, it is stated. For a number of years the Erwin Light & Power Company has purchased its power from the Tennessee Eastern Electric Company, now a unit of the Doherty organization.

Permission is sought from the Massachusetts Department of Public Utilities by the Edison Electric Illuminating Company of Boston to buy the distribution systems of the towns of Maynard and Acton, now served by the American Woolen Company. Recently the American Woolen Company sold its distribution systems at Royalston and South Royalston to the Gardner Electric Light Company.

There was no opposition before the New York Public Service Commissioner to the transfer of the Norwood Electric Light & Power Company, Yalesville, to the St. Lawrence Valley Power Corporation or to transfer by the Norwood company to the St. Lawrence County Utilities of its franchise and system in Norwood and Norfolk. A third unopposed petition was from the St. Lawrence Securities Company to acquire the outstanding capital stock of the Antwerp Light & Power Company.

The Theresa Hydro-Electric Company and the Santway & Vogt Company have disposed of their water-power plant and distribution system at Theresa, N. Y., to the Antwerp Light & Power Company, a subsidiary of the St. Lawrence County Utilities of Potsdam, N. Y. The agreement includes a plan for raising the lower dam to a height of 19 ft., giving a fall of 72 ft. The holdings of the Santway & Vogt Company included mill property with water rights.

Mayor Painter of Radford, Va., has been told by Herbert Markle, district manager Appalachian Electric Power Company, that $275,000 is the maximum offer his company will make for Radford's electric utility. Mr. Markle is quoted as asking that when the Appalachian company's dam gets under way the proposal of purchasing the municipal plant be submitted to the voters.

The Central Illinois Public Service Company has been authorized by the Illinois Commerce Commission to purchase the Smithfield Light & Power Company for $9,000.

The village board of Adams, Neb., has voted to sell its electric distributing system to the Iowa-Nebraska Light & Power Company, from which it has been buying energy wholesale.

On April 16 voters will decide whether to sell the electric light system at Lake Norden, S. D., to the Union Public Service Company of Canby, Minn., for $6,000.

Permission has been granted by the California Railroad Commission to the Southern California Edison Company to sell to the city of Pasadena that portion of its electrical distributing system in Eaton Canyon Addition for the sum of $32,312.

A United States syndicate has been negotiating for the franchises of the four Vancouver Island towns of Courtenay, Minto, Royston and Cumberland, with the object of purchasing the electric light and power plants in each district. The municipal plant at Courtenay, the Cumberland Electric Light Company's plant and the plant of the Royston Electric Light & Power Company are involved. Negotiations are being carried on to get an option on the plant of the Minto Electric Light & Power Company.

Development of Stamp Falls, on Vancouver Island, British Columbia, is forecast because of an offer from unnamed investors to the Port Alberni civic authorities to purchase the municipal power plant for $125,000 and the city's water rights at the falls. Development of Stamp Falls would cost about $500,000.

Boston Edison Merger Rumor Untrue, Edgar Says

Press reports in Boston early this week that financial interests identified with the banking house of J. P. Morgan & Company had acquired control of the Edison Electric Illuminating Company of Boston and that a great merger of utilities in eastern New England was about to take place under these auspices were declared to be without foundation by President Charles L. Edgar of the Edison company upon inquiry by the ELECTRICAL WORLD. To a representative of this journal Mr. Edgar said on Monday that the Edison company has acquired a site for a new steam generating plant at Everett at a cost of about one million dollars; that within a few years from fifteen to twenty millions will be expended there to serve better the northern district of the company's territory, and that construction of a switching station to tie into the New England Power Association's system through Woburn is expected to start this summer.

By the fall of 1930 it is expected that energy from the Fifteen-Mile Falls development of the New England Power system will be available for transmission into eastern Massachusetts. Negotiations between the companies have resulted in a primary power agreement which has postponed the necessity for enlarging the Edgar station at the present time, and a proposed agreement for the utilization of secondary power by the interconnected systems is about to be consummated. Merger announcements in the press relative to the Massachusetts Gas Companies have no accuracy with respect to the Boston Edison Company, Mr. Edgar stated, and he pointed out that the operating agreements between his organization and the New England Power Association should not be interpreted with financial significance.

"Light's Golden Jubilee" Essay Contest

W. S. Vivian, chairman of the N.E.L.A. public speaking committee (Public Relations Section), announces that N. H. Boynton, in charge of sales promotion, National Lamp Works, and representing "Light's Golden Jubilee" committee, offers a first prize of $150 cash and a second prize of $75 cash to the two employees of member companies of the N.E.L.A. who prepare the best two essays on "Light's Golden Jubilee." These essays in general should briefly treat of the history of light, its successive stages of development, the invention of the incandescant lamp by Edison, what modern lighting means both to our present civilization and the electric light and power industry and what the electric light and power industry has, through light, contributed to the progress of the nation. Contestants may write to W. M. Skiff, chairman Speakers' Bureau, Nela Park, Cleveland, Ohio, and he will supply them with informative material on "light."

Any employee of a member company of the N.E.L.A., excepting officers, managers, general office department heads and those who specialize in the sale of light, is eligible to compete. Essays should not contain more than 1,500 words and should be received by Mr. Skiff on or before May 15. Further conditions to be observed, of which there are several, will be supplied by him.

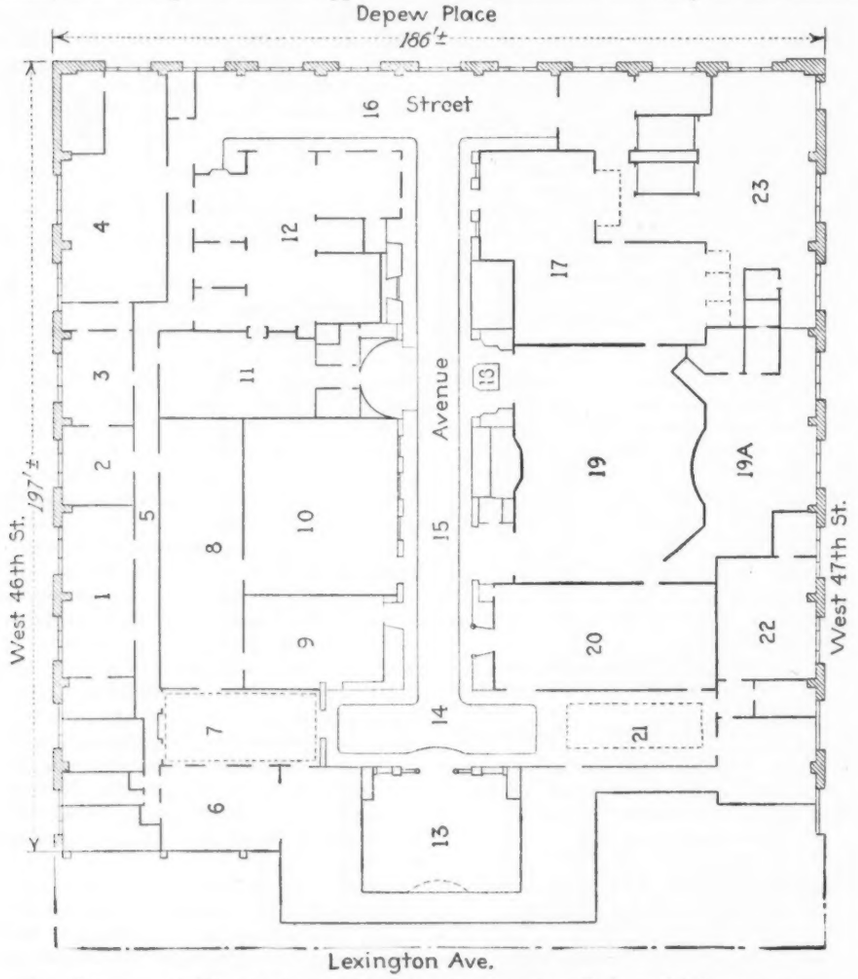
Westinghouse Lamp Company Lighting Institute

Spacious Floor in New York City Will Be Devoted to Laboratory Where Competitors' Equipment as Well as Its Own Will Be Exhibited

MUCH interest has been aroused in electric utility and lighting circles by the Westinghouse Lamp Company's announcement, just made, that it is about to establish the Westinghouse Lighting Institute for the display of illuminating equipment—its competitors' as well as its own—and as a laboratory where any one can test lighting effects, even on the scale involved in floodlighting a skyscraper.

The Institute will occupy an entire floor (more than 40,000 sq.ft.) of the Grand Central Palace in New York City and is designed to afford a working demonstration of the latest developments in illumination wherever applied. The appearance of streets, offices, factories, stores, show windows, theaters, schoolrooms, residences and garages has been simulated closely in the various subdivisions of the floor, so that every piece of equipment and every lighting effect will be seen in its natural environment, and wiring and control apparatus are installed to the best practical advantage. It is not intended to try to make room for every new piece of equipment, but many types, constantly changing, will be shown and the availability of other types will be made clear.

With great public spirit, the Westinghouse company has undertaken the heavy expense involved in the interest of the further development and progress of artificial illumination. The exhibit will be directed by Ralph Neumuller, who is well known in the electrical industry, having formerly been manager of the advertising and merchandising activities of the United Electric Light & Power Company, New York, and an active member of N.E.L.A. committees.



Lay-out of Westinghouse Lighting Institute's offices and laboratory

Room 1 — General office. 2—Director's office. 3—Conference room. 4—"Circle W" room. 5—Corridor. 6—Reception room. 7—Public hall. 8—Transportation and aviation. 9—Electrical store. 10—Industrial lighting. 11—Automotive. 12—Home. 13—Loggia. 14—Court. 15—"Mazda Avenue." 16—Cross street. 17—Electrical advertising. 18—Department-store front. 19—Auditorium and stage. 20—Central-station display room. 21—Art gallery. 22—School lighting. 23—Shop.

European Engineers to Visit Us on Way to Tokyo

Arrangements for the reception of one hundred of Europe's most distinguished engineers and scientists, who will arrive during the summer en route to the World Engineering Congress at Tokyo, have been placed in charge of Roy V. Wright, president of the United Engineering Societies, as chairman of the New York reception committee, according to announcement from Maurice Holland, executive secretary of the American committee of the congress, of which Dr. Elmer A. Sperry is chairman. Mr. Wright will be aided by a committee of New York engineers.

Besides two delegations of approximately forty each from Great Britain and Germany respectively, engineers from Sweden, Denmark, France and Italy are expected to arrive in August and September. Each of these countries has indicated that its foremost engineers will be included in its delegation. Mr. Wright's committee will plan inspection trips for the foreign delegations and arrange for their entertainment and transportation while here.

The foreign delegations will sail from the Pacific Coast for Japan about the time that the American delegation, which is now composed of 235 engineers from all parts of the country and their families, sails from San Francisco. The American party has reserved a special ship and will embark at San Francisco on October 11.

With Mr. Wright on the New York reception committee are Bancroft Gherardi, J. V. W. Reynders, F. R. Low, C. O. Mailloux, A. W. Berresford, H. Foster Bain, F. L. Hutchinson, Calvin W. Rice and George T. Seabury. Offices will be set aside for the visitors in the headquarters of the American committee of the World Engineering Congress at the Engineering Societies Building.

The Japanese Ambassador, Katsuje Debuchi, will be the guest of honor at a dinner to be given by the American committee at the Carlton Hotel in Washington on April 24 during the annual meeting of the National Academy of Sciences. John Hays Hammond is in charge.

Philadelphia Firm Protests Against Utilities

The Merchant & Evans Company of Philadelphia, which sells lighting appliances, has filed with the Federal Trade Commission a protest against having to compete with utility companies, which it charges with "needless, destructive, wasteful and often illegal competition at public expense in the fields of private enterprise." Powell Evans, president of the company, says in his complaint:

"In view therefore of this virtually universal destructive public utility competition everywhere in the appliance field and the definite current trend toward even more extravagant and intensive competition from this source for the future, with eventual monopoly in view, it has become a matter of life and death for all independent interests opposed to public utility purposes and methods in this business to establish communication and co-operation and jointly organize a process and plan of correction in every city and state and at Washington."

The complaint filed by the company named fifteen utilities companies in the gas and electric field in Pennsylvania, New Jersey, Delaware, Maryland and New York.

Briefer News

LOWER RATES FOR GREEN BAY TERRITORY.—The Wisconsin Railroad Commission has authorized the Wisconsin Public Service Corporation to revise its present rates for lighting, heating and cooking purposes. The company estimates that the new schedule will reduce its total revenue about $42,000 annually, benefiting small users of electricity in and around Green Bay, Oconto and Oshkosh.

POWER COMPANY PLANTS TWO AND A HALF MILLION TREES IN NORTHERN NEW YORK.—The Malone (N. Y.) Light & Power Company will plant a million Norway spruce trees during the coming summer on a tract owned by the company along the Salmon River in the Titusville section. When this work is completed the company will have planted two and one-half million trees in three years.

THUNDERSTORM THROWS 300,000 EXTRA KILOWATTS ON NEW YORK COMPANIES' LOAD.—A sudden thunderstorm which swept over New York City on the afternoon of April 4 added 300,000 kw. to the Edison companies' load, bringing a peak of 1,014,400 kw. at 3:45 p.m. The difference between this load and normal load, President Sloan said, was five times greater than the difference met during a recent prize fight, when thousands of boxing enthusiasts sat up late to get returns

SURVEY OF PLATTE RIVER BASIN MAY INVOLVE POWER GENERATION.—Twenty-five army engineers have begun a survey of the Platte River basin in Nebraska in connection with flood-control work and to determine whether a series of storage reservoirs can be constructed at various points to retain these waters in time of flood. Governor Weaver has assigned Prof. Clark E. Mickey of the state university engineering faculty, who has made surveys in the past in connection with the Tri-County project, and engineers from the State Department of Public Works to co-operate with the government group and to recommend plans for economic application of the stored waters for irrigation and possible power purposes.

SECOND 220-KV. LINE FROM GATINEAU POWER STATION TO LEASIDE WILL COST $2,150,000.—It has been estimated that the total cost of the second 226-mile, 220-kv. transmission line from the Paugan Falls station of the Gatineau Power Company to the Leaside station of the Ontario Hydro-Electric Commission will be approximately $2,150,000. Of this amount the Gatineau Power Company will have $450,000 to bear for the construction of its share of the line from Paugan to Chats Falls, where the Ontario Hydro takes it over. Construction on the new line will begin the latter part of this year. Each line will have a designed capacity load of 130,000 hp. Between them the contract for 260,000 hp. will be filled by 1931, the date when the contract calls for completion of the full amount.

DEFEAT OF MUNICIPAL OWNERSHIP AT CHIPPEWA FALLS, WIS., WAS DECISIVE.—Defeat of the two proposals for municipal ownership at Chippewa Falls, Wis., reported last week on page 700, appeared overwhelming when the full returns were received. The proposal to purchase the Northern States Power Company's electrical distribution system was defeated by 2,039 to 470, and that calling for the purchase of two water-power sites at Glen Loch Dam by 2,107 to 404. This makes the fourth time that municipal ownership advocates have lost in Chippewa Falls.

NORTHERN STATES INTERCONNECTED SYSTEM LITTLE TROUBLED BY TORNADO.—Vindication of the Northern States Power Company's interconnected steam

and hydro system, if any were needed, came on April 5 when a tornado ripped through parts of Wisconsin and Minnesota, causing 24 deaths and heavy property loss, including much damage to communication systems. Although the transmission lines from the company's hydro plants were all put out of commission temporarily, the steam plants at Minneapolis and St. Paul at once picked up the load. Breaks on a number of lines—the Coon Rapids, the southern and northern lines in Wisconsin, the St. Croix line and others—followed one another in rapid succession, but so quickly were the necessary switchings and readjustments made that the total suspension and inconvenience was almost negligible.

SWIFT CREEK PLANT AT JUNCTION OF LEWIS RIVER WOULD FURNISH 12,000 HP.—Further details of the hydro-electric project on Swift Creek in Skamania County, Wash., at the junction of Lewis River, for which rights are sought, as already reported, by George McCoy of Vancouver, Wash., give its estimated output at 12,000 hp. It would be built about 28 miles northeast of Stevenson, would require 125 sec-ft. of water and the total fall would be 850 ft. A timber crib dam, 20 ft. high, 100 ft. along the top and 50 ft. along the bottom, would be constructed, and a flume line 2¾ miles in length would convey the water to the power plant, where two 5,000-kva. generators would be installed.

CHAMBER OF COMMERCE TO MEET AT WASHINGTON, APRIL 29-MAY 3.—The seventeenth annual meeting of the United States Chamber of Commerce will be held at Washington in the week of April 29-May 3. Among the great variety of business and trade topics that will come before it is that of "government ownership interference with water-power development." This will be the subject matter of a "round-table" conference, when the question will be asked, "Is privately owned electrical industry seriously threatened by government-owned water-power competition?"

FRENCH COURTS DECLARE ELECTRICITY DUTIABLE.—A case has just been concluded in the courts at Belfort, France, in which the French customs authorities sued an electricity company for 80,000,000 francs ($3,200,000) for non-payment of import duty on electrical energy obtained from Switzerland. The company resisted the claim, asserting that electrical energy, being imponderable, could not be taxed. The court decided in favor of the law and ordered the company to pay to the authorities 40,000,000 francs as duty, an additional 40,000,000 francs as a fine and smaller amounts for costs.

PUGET SOUND COMPANY ADDS $2,500,000 TO BUDGET.—The 1929 budget of the Puget Sound Power & Light Company, Seattle, originally placed at $9,000,000, has been increased by $2,500,000 because the company has decided to install the second 50,000-hp. steam unit in its new Shuffleton plant near Renton, Wash. The plant with one such unit, now well advanced in construction, is to be ready for operation September 1, 1929. The installation of the second unit is to go forward concurrently with the first, and completion of this second unit is scheduled for August, 1930. Details of the company's original budget were published in ELECTRICAL WORLD for January 26 (page 214).

SHORT COURSE FOR CHICAGO WOMEN IN ELECTRICAL HOMEMAKING. — More than seventy members of the women's division of the Electric Association of Chicago have registered for a short course which is being conducted to acquaint them with the origin and application of electricity. The course includes a lecture on the generation of electricity, with working model, which was given at the Electric Club April 2; a lecture on wiring and lighting, with working model, given at the club April 9; a demonstration of washing machines, ironers and refrigerators to be held at the Electric Shop of the Commonwealth Edison Company April 16; a demonstration of table appliances at the Public

Service Company model home in Oak Park, April 23, and a demonstration of electric ranges at the factory of the Edison Electric Appliance Company April 27.

SANTA CRUZ TO VOTE ON DISTRIBUTION OF POWER BY MUNICIPALITY.—An ordinance has been adopted by the City Council of Santa Cruz, Calif., fixing next Tuesday as the date when the voters will decide whether the municipality shall enter the business of distributing electric power. The People's Construction Company of San Francisco has offered to build a power plant on the San Lorenzo River and transmit power to be distributed by the municipality. The city would agree to buy electrical energy for 40 years and at the end of that time the plant would revert to the city. At present the community is served by the Coast Counties Gas & Electric Company.

DETROIT EDISON COMPANY COMPLETES SEVERAL CONSTRUCTION JOBS.—Construction work on the Detroit Edison Company's new 24,000-volt outdoor switching station at Marysville has been completed, and this station will be ready for operation as soon as lines can be cut over from the switch house in the power plant. The Burtch substation has been completed at the southwest corner of the Burtchville-Grand Town Line Road and the Lakeport-Blaine Road to serve the villages of Blaine and Jeddo and vicinity northwest of Port Huron, thereby relieving Pine Grove substation. A new metering station has been completed at Lakeport, about 8 miles north of Port Huron. Alteration work at McGraw substation, changing it over to a class "C" station similar to the remodeled Hart substation, is nearing completion. The substructure for the new Turner substation has been completed, and steel erection work is well advanced.

IOWA MEN DISCUSS POWER AND INDUSTRY.—Representatives of public utilities and other Iowa industries gathered with members of the faculties of the Iowa State College and of the State University of Iowa at Iowa City, April 2 to 4, to discuss Iowa's material resources and means for developing new industries. The availability of electric power for all possible present and future needs was pointed out by executives of the electrical industry. Market and distribution problems were discussed by representatives of the industries, of the faculties and the United States Department of Commerce. There was considerable discussion of the development of new industries which are being started, based on the state's raw materials. Among the utility and electrical men who took part were Joe Carmichael, Des Moines; L. R. King, Davenport; Arthur Huntington, Cedar Rapids; A. D. Altree, Chicago; J. T. Rood, professor of electrical engineering, University of Wisconsin; R. D. Hayes, Dubuque, and Charles C. Clark, Des Moines.

INDIANA COMMISSION STILL WRESTLING WITH INSULL MERGER.—Indianapolis reports indicate a coming change of policy on the part of the Public Service Commission in handling the proposed seventy-million-dollar merger of Insull electric, gas and interurban railway properties in that state. The problem of evaluating these properties has for months strained the resources of the commission in men and money available for the investigation. It is now reported that John W. McCardle, former chairman of the commission, will be reappointed to that office, in succession to Frank T. Singleton, and that by a three-to-two vote in the commission the engineering force of seven men and the accounting force of four men investigating the merger programs will make all future reports to the heads of these two departments, without being responsible for direction or co-ordination of their efforts and work to any one commissioner. Just how this will affect the utility interests involved is problematical.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for January 5, page 80.]

Great Lakes Division, N.E.L.A.—Engineering Section, Drake Hotel, Chicago, April 18-20. Miss S. J. Bowles, 205 Illinois Mine Workers' Bldg., Springfield, Ill.

American Welding Society—Engineering Societies Bldg., New York, April 22-26. M. M. Kelly, 29 West 39th St., New York.

Middle West Division, N.E.L.A.—Hotel Fontenelle, Omaha, Neb., April 24-26. T. A. Browne, Lincoln, Neb.

Southwestern Division, N.E.L.A. — Arlington Hotel, Hot Springs, Ark., April 30-May 3. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Southwestern Public Service Association—Hot Springs, Ark., April 30-May 3. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.

Arkansas Utilities Association — Arlington Hotel, Hot Springs, Ark., April 30-May 3. R. I. Brown, Arkansas Power & Light Co., Little Rock, Ark.

Indiana Electric Light Association — Hotel Gary, Gary, Ind., May 1-3. William Stokes, 1548 Consolidated Bldg., Indianapolis, Ind.

American Institute of Electrical Engineers—Regional meeting, Dallas, Tex., May 7-9; summer convention, Swampscott, Mass., June 24-28. F. L. Hutchinson, 33 West 39th St., New York.

East Central Division, N.E.L.A. — Louisville, Ky., May 7-10. D. L. Gaskill, Greenville, Ohio.

Southeastern Division, N.E.L.A.—Asheville, N. C., May 8-10. C. M. Kilian, 207 Bona Allen Bldg., Atlanta.

Missouri Association of Public Utilities —Bothwell Hotel, Sedalia, May 16-18. F. D. Beardslee, 315 N. 12th St., St. Louis.

National Electrical Manufacturers' Association — The Homestead, Hot Springs, Va., May 20-25. S. N. Clarkson, 420 Lexington Ave., New York.

American Electrochemical Society—Toronto, May 27-29. C. G. Fink, Columbia University, New York.

National Electrical Wholesalers' Association—The Homestead, Hot Springs, Va., May 27-31. E. Donald Tolles, 165 Broadway, New York.

National Electric Light Association—Atlantic City, N. J., June 3-7. A. J. Marshall, 420 Lexington Ave., New York.

North Central Electric Association—Breezy Point, Pequot, Minn., June 16-18. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Association of Iron and Steel Electrical Engineers—Pittsburgh, June 17-21. J. F. Kelly, 1007 Empire Bldg., Pittsburgh.

Canadian Electrical Association — Algonquin Hotel, St. Andrew's by the Sea, N. B., June 19-21. H. M. Lyster, 712 Power Bldg., Montreal.

Pacific Coast Electrical Association—Del Monte, Calif., June 19-22. S. H. Taylor, 447 Sutter St., San Francisco.

Society for the Promotion of Engineering Education—Ohio State University, Columbus, June 19-22. F. L. Bishop, University of Pittsburgh, Pittsburgh.

Northwest Electric Light and Power Association—Seattle, June 26-29. B. Snow, 1206 Spalding Bldg., Portland, Ore.

SIOUX FALLS TO VOTE ON MUNICIPAL PLANT EXPANSION.—Sioux Falls, S. D., will vote April 16 on a bond issue of $100,000 for expansion of the municipal electric plant to supply electric light and power to private consumers in competition with the Northern States Power Company. The expansion also would provide for supplying energy for lighting the streets and public buildings and power for the city water plant. The Sioux Falls *Argus-Leader* disapproves the project, asking "why the city should enter into competition with a private company that is giving good service at reasonable rates."

PURDUE GIVES HOUSEHOLD EQUIPMENT COURSE FOR WOMEN. — In cooperation with the School of Home Economics of Purdue University, Lafayette, Ind., the electric and gas companies of the Hoosier State acted in the last week of March as sponsors for a short course in household equipment which was attended by almost one hundred women from Indiana, Wisconsin, Michigan, Illinois and Ohio employed in the utility business. Dean Mary L. Matthews was in active charge of the course. Manufacturers of many kinds of household machinery and appliances operated by electricity or gas sent displays of their products, and many men and women prominent in utility circles addressed the classes.

ONTARIO POWER TRANSMISSION SUFFERS FROM GALE.—Power lines and telephone and telegraph service suffered in a furious gale which swept Ontario on April 1, said to have been the most violent in twenty years. Electrical service in many parts of the province was disrupted with a consequent loss to industries and a general tie-up in business. Woodstock was entirely without power for some time, and just outside that place the wind tore down the high-tension cables that carry power to neighboring towns and villages. The gale wrought havoc at Niagara Falls, Ontario, where the steel framework which carries a flagpole in front of the city hall was blown across trolley and telephone wires. Many large industrial plants were affected. Hundreds of poles were also blown down on the Georgian Bay system of the Hydro commission, and during the greater part of the day the town of Barrie, north of Toronto, was without power and light.

New York Transit Commission Upheld

United States Supreme Court Declares Interference of Federal District Court in Subway Fare Controversy "Improvident and Beyond Proper Discretion"

DECLINING to find the 5-cent fare of the Interborough Rapid Transit Company of New York City confiscatory, the United States Supreme Court on Monday of this week, in the course of a long judgment, criticised the United States Court for the Southern District of New York because it granted an interlocutory injunction to prevent the New York Transit Commission and the City of New York from interfering with the collection of a 7-cent fare pending adjudication in the state courts. The Supreme Court, with three members dissenting, dissolved the injunction granted by the lower court, saying:

Considering the entire record, we think the challenged order was improvident and beyond the proper discretion of the court. The record is voluminous; the contracts between the parties are complex; the relevant statutes intricate. No decision of this court or any court of New York authoritatively determines the questions at issue. The basic one calls for construction of complicated state legislation.

To support the action of the court below, it would be necessary to show with fair certainty, first, that before the original bill was filed the commission had taken, or was about to take, some improper action in respect of the Interborough company's new schedules or its application for leave to discontinue the 5-cent rate and establish one of 7 cents, and, secondly, that the 5-cent fare was so low as to be confiscatory while the proposed change to 7 cents was reasonable. We think neither of these things adequately appears from the record.

At most, prior to the original bill, the commission's members had accepted the view that it lacked jurisdiction to permit a new rate because the existing one was irrevocable fixed by lawful contracts and had determined promptly to seek enforcement of the city's supposed rights by proceedings in the state courts. This was neither arbitrary nor unreasonable. No ground existed for anticipating undue delay or hardship. The purpose of the commission was in entire accord with rulings announced as early as 1920 and seemingly no longer controverted when in 1925 the Interborough applied for legislative relief. There had been abundant opportunity to test the point of law by appeal to the state courts.

Recent Court Decisions

COUNTY ENGINEERS' AUTHORITY TO DICTATE POSITION OF POLES ON IOWA HIGHWAYS.—The Supreme Court of Iowa, in Central States Electric Company vs. Pocahontas County, held that the company, to which the Railroad Commission had granted authority to erect a high-voltage transmission line along a highway, had been properly enjoined from placing its line of poles at a place other than that designated by the county engineer, the law prescribing that new "lines" shall be located by the county engineer referring to poles. (223 N.W. 236.)*

ELECTRIC WIRE USED IN MANUFACTURING BUSINESS NOT A "HIDDEN DANGER," DESPITE ABSENCE OF INSULATION THROUGH WEAR.—A judgment for the defendant in Minick vs. Windsor Brick Company was affirmed by the Ohio Court of Appeals, which declared that damages could not be collected because of injury to a boy who, while on manufacturing premises for his own purposes, came into contact with an electric wire used in the business, from which wire the insulation had been worn. The boy, the court held, was at the most a licensee to whom the company owed no special duty, and the wire was not a "hidden danger." (164 N.E. 769.)

THAT EXERCISE OF JURISDICTION BY COMMISSION WILL INFLICT HARDSHIP IS NOT GROUND FOR PROHIBITION.—The Supreme Court of the State of Washington has found, in State ex rel. Grays Harbor Railway & Light Company vs. Denney, that the company has no ground for objecting to the exercise of jurisdiction by the Department of Public Works because a hardship might be inflicted on the company through the expenditure necessary for it to incur in the valuation of its property. This expenditure, the court points out, will be one voluntarily assumed by the company, not made compulsory by the law. If it should finally appear that the department was proceeding improperly, the company would have an adequate remedy by appeal. (274 Pac. 791.)

SPECIFIC AVERMENTS OF NEGLIGENCE DO NOT RESTRICT GENERAL ALLEGATIONS.—A directed verdict for the defendant in Simmons vs. Terrell Electric Light Company sustained by the Court of Civil Appeals of Texas (ELECTRICAL WORLD, March 17, 1928, page 578) has been reversed by the Commission of Appeals and the suit remanded for retrial. The lower courts found for the company on the ground that testimony regarding certain details of injury to the plaintiff through being struck in the eye by a broken electric wire were not credible. The Commission of Appeals held that these specific averments should not have led to the withholding of the case from the jury despite the general allegations, inasmuch as evidence tended to show that the plaintiff was in a place where he had a right to be, that the wire was in a place where the defendant had no right to have it, that it fell and produced injury, and inasmuch as the reason for its falling was not directly shown. (12 S.W. [2d] 1011.)

CITY ORDINANCE FOR LICENSE OF ELECTRICIANS SUSTAINED.—Becker vs. Pickersgill was an appeal against conviction for violation of an ordinance of the city of Perth Amboy, N. J., providing for the examination and registration of master and journeyman electricians, fixing the fees for such registration and providing penalties for a violation of its provisions. Becker was convicted of engaging in the business of a master electrician without first having passed an examination and registered as provided in the ordinance. Becker attacked the ordinance on the ground that the city had no authority to license electricians, that the ordinance was not designed to promote the public health, safety and general welfare; that the ordinance was not designed to regulate and was in fact one for revenue only, and that said ordinance was unconstitutional in that it deprived the prosecutor of his personal right and property and was a denial to him of the equal protection of the law. The New Jersey Supreme Court sustained the ordinance and affirmed the conviction. (143 At. 859.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

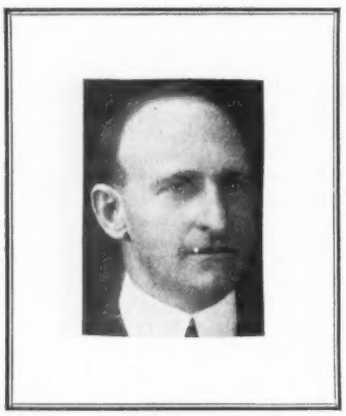
DISCRIMINATING BETWEEN URBAN AND RURAL COMPANIES.—Electric customers in the unincorporated village of Rosemond, Ill., filed complaint with the Illinois Commerce Commission that the Central Illinois Public Service Company had refused to extend service to them unless they paid the construction cost of the extension. It appears that they regarded themselves as urban rather than rural consumers. Sustaining the company's position, the commission said: "The commission recognizes that in many communities in Illinois, whether incorporated or unincorporated, electric public utilities may and do experience difficulty in deciding definitely those customers that should be classified as rural instead of urban. It is not unreasonable to assume that there are many conditions in the state similar to this case, where under a strict interpretation of rate schedules certain existing customers should be classified other than now classified. It appears, therefore, that each individual case as it is brought to the attention of the commission should be decided on its individual merits, using those facts available as a basis."

WHAT RATE OF ANTICIPATED RETURN JUSTIFIES ORDER TO EXTEND LINES?—The Connecticut Public Utilities Commission has ruled that a 20 per cent gross return on the cost of a proposed extension of distribution lines into new territory is not unreasonable, being, in fact, rather less than the percentage usually asked by light and power companies. The commission said: "Different plans have been adopted in making such [unprofitable] extensions, some approved by the commission and some by mutual agreement between the company and the prospective patrons, but all involving some additional payment over and above the regular rates. In some cases cash or equivalent contributions have been made toward the cost of constructing the line, the patrons then receiving the service at regular rates; in other cases a guarantee that the company will receive an annual gross revenue of at least a stated amount for a term of years, and in still other cases an increased rate for the customers along the extension, or a combination of increased rate and guarantee whereby the company is assured of at least a stated amount of annual gross revenue for a term of years, etc. Certain companies have adopted rules pertaining to such extensions, some companies establishing a predetermined fixed charge per customer per month for each 100 ft. of extension in excess of the ordinary free extension service, irrespective of the total cost of the extension, while other companies have established a predetermined fixed charge per customer per mile, the amount depending upon the number of customers per mile and irrespective of the cost of the extension."

News About Men of the Industry

E. B. Neiswanger Heads San Antonio Utility

E. B. Neiswanger, formerly vice-president and general manager of the Central Power & Light Company, San Antonio, was elected president and general manager of the company at a meeting of the board of directors held March 29. James C. Kennedy of Dallas, formerly president, was elected vice-chairman and Martin J. Insull of Chicago was elected chairman. For 30 years Mr. Neiswanger has been engaged in numerous phases of electrical, mining,



irrigation and development engineering. Since 1913, when he became associated with the Texas Power & Light Company as chief engineer, and later as consulting engineer for various utility companies, he has been identified with the development of the utility business in Texas. As a consulting engineer he saw the possibilities for future development in the lower Rio Grande Valley, and in 1923 he went there to supervise the utility development for Morrison & McCall. Since that time he has been actively engaged in promoting the welfare of the valley and of south and southwest Texas in general.

On July 1, 1925, when the Middle West Utilities Company of Chicago purchased the Central Power & Light Company, Mr. Neiswanger was promoted from the old organization to the position of vice-president and general manager.

YUJI KUSAKARI of Tokyo, Japan, chief engineer and secretary of the Kyushu Electric Railway Company, Ltd., is on a visit to this country. Last week he inspected the large electric plant of the Texas Power & Light Company at Trinidad, studying closely the methods of mining lignite and its use as fuel. While in Texas Mr. Kusakari conferred with John W. Carpenter, president and general manager of the Texas Power & Light Company, who told him of some of the important steps along industrial lines which have been accomplished in Texas within the last ten years, including the use of lignite to provide electric power for industrial purposes. He was interviewed by E. T. Keck, superintendent of power for the Texas Power & Light Company. Mr. Kusakari will visit New York, returning to Japan by way of Europe.

C. R. STEWART, formerly assistant to the consulting engineer and power engineer with the Raritan Copper Works, Perth Amboy, N. J., has joined the mechanical engineering division of the Stone & Webster Engineering Corporation at Boston. Mr. Stewart's previous career includes several years with the Southern California Edison Company at Los Angeles, the Standard Oil Company at El Segundo, Calif., and the Inspiration Consolidated Copper Company at Miami, Ariz.

R. M. HENDERSON, who has been vice-president of Dwight P. Robinson & Company in charge of construction, is now managing director of United Engineers & Constructors (Canada), Ltd., with headquarters in the Drummond Building, Montreal. The formation of this company is announced by Dwight P. Robinson, president United Engineers & Constructors, Inc., Philadelphia, who says that it will execute engineering and construction work of any character in any part of Canada. Mr. Henderson will reside in Montreal and devote virtually all his time to the management of the Canadian company.

M. L. CUMMINGS, JR., who has been associated with the advertising and public relations activities of the Utah Power & Light Company for several years, has recently been placed in charge of advertising and publicity for the Utah Light & Traction Company, Salt Lake City, Utah. Mr. Cummings is also editor of the Utah Power & Light Company's house organ, the *Synchronizer*. He has been closely associated with the Electrical League of Utah ever since it was organized about nine years ago. He has served as chairman of its publicity committee and as chairman of its Christmas home-lighting committee for the past four years. He was recently elected secretary and treasurer of that organization for the year 1929.

DAVID C. ADIE of Buffalo, N. Y., was recently named as a member of the Public Service Commission of New York State by Governor Roosevelt to fill the vacancy caused by expiration of the term of William R. Pooley. In 1914 Mr. Adie was associated with the Minneapolis Civic and Commerce Association and was personal secretary of the organization, having charge of the civic division. Later he became associated with the Public Safety Commission of Minnesota, was with Major Gitchell in the office of the Secretary of War, and then was the associate secretary of the Labor Policies Board. He was also secretary of the Charities Organization Society of Buffalo.

W. H. Sawyer Makes Gift to Alma Mater

W. H. Sawyer, president of Stevens & Wood, Inc., has given $2,000 to the University of Nebraska, the income of which is to go yearly to the upper class man selected by the dean of the College of Engineering and the chancellor, on the basis of scholastic record and character, as well as upon his financial need. This offer on the part of Mr. Sawyer was in response to a recent request of university authorities asking for a number of contributions for

worthy and needy students. Mr. Sawyer indicates that his preference is for electrical engineering students. Mr. Sawyer was graduated in that course in 1894 and rounded out his technical training with practical work for the General Electric Company for the next ten years. Later he became vice-president of E. W. Clark & Company Management Corporation, Columbus, Ohio, and subsequently president of the East St. Louis & Suburban Railway Company and affiliated properties. In 1926 he served as advisory counsel for the Victoria (Australia) government in connection with power generation and distribution. Mr. Sawyer is now president of Stevens & Wood, Inc., and a vice-president of the Allied Power & Light Corporation.

L. E. MORSE has been appointed secretary of the Washington Water Power Company, to succeed Vincent G. Shinkle, who resigned last year, according to the announcement of M. W. Birkett, vice-president and general manager. Mr. Morse entered the employ of the company in 1907 as a collector and through a series of promotions rose to the position of assistant secretary-treasurer in 1923.

HARVEY A. KEYS has been appointed manager of the merchandise division, Byllesby Engineering & Management Corporation, effective April 15, according to W. H. Hodge, vice-president and manager of the sales and advertising department in Chicago. Mr. Keys suc-

ceeds J. W. DEVEREAUX, who has been appointed assistant to Mr. Hodge in charge of special investigations. Mr. Keys has been vice-president and general manager of the Equitable Sales Company of Pittsburgh, a subsidiary of the Philadelphia Company, since 1921, and is widely known for successful accomplishment in the retail distribution of electric and gas appliances. His new duties will give him supervision over appliance merchandising at all Byllesby utility properties.

GEORGE W. HOLDEN, formerly New England sales manager of the Edison Storage Battery Company, has become associated with Stone Operating Service, Inc., battery maintenance engineers and representatives of "K-W" storage batteries. His headquarters are in South Boston, Mass.

RUSSELL T. JOHNSON, who has been general manager of the Scioto Valley Railway & Power Company, was elected president of that company at a meeting of the stockholders held in Columbus, Ohio, March 28. He succeeds F. A. Davis, who resigned as president to accept the newly created office of chairman of the board.

W. L. BIRD has been appointed vice-president of the Kaministiquia Power Company of Canada. Mr. Bird is a fellow of the American Institute of Electrical Engineers, past-president of the Canadian Electrical Association and a member of the hydraulic committee of the National Electric Light Association.

ABE VOGEL, who was president and general manager of the East Missouri Power Company at Troy, Mo., with which the Missouri Edison Company of Louisiana, Mo., has been merged, will manage the merged companies with headquarters at Louisiana.

LANDON K. THORNE has been elected a director of the United Gas Improvement Company to succeed the late William Wood. Mr. Thorne, who is president of Bonbright & Company, has been a member of the United Gas Improvement executive committee since November, 1928.

ROBERT H. GRIFFIN, formerly connected with the New York staff of E. H. Rollins & Sons, has been elected a vice-president of the Southern Cities Utilities Company and the Whetstone Engineering Company, according to an announcement made from the Philadelphia headquarters of these affiliated companies.

E. F. WHITNEY, manager of the Portland office of the General Electric Company since 1923, has been appointed assistant manager of the east central district with headquarters at Cleveland. Mr. Whitney was graduated from the Massachusetts Institute of Technology in 1907. After his graduation he entered the test department at the company's Schenectady works and then the commercial training course. Upon completion of this course he was assigned to the San Francisco office, later transferred to the Seattle office, and from there to Portland.

Major Edgerton to Leave Federal Power Commission

Major Glen E. Edgerton has been ordered to the U. S. Military Academy to serve as an instructor in civil and military engineering, after having served for five years with the Federal Power Commission. Before becoming chief engineer of the commission, Major Edgerton occupied the office of assistant chief. In that period he supervised the engineering and economic work during more than half the life of the commission since its organization in 1920. Before the end of his term of service he will have passed on nearly 300 licenses, representing more than 4,000,000 hp. Among the larger projects covered by the investigations of which Major Edgerton was in

charge are Conowingo on the Susquehanna Saluda River, S. C.; Priest Rapids on the Columbia, Big Pigeon River in North Carolina and the Savannah River above Augusta. In addition, he was in charge of the important work done in connection with the applications for rights on the Potomac and at Cumberland Falls.

Before joining the Federal Power Commission Major Edgerton was for two years the director of sales for the War Department. He served five years as chief engineer of the Alaskan Railroad Commission and two years on the Panama Canal. In addition to his duties as chief engineer of the Federal Power Commission Major Edgerton also serves as a member of the Board of Engineers for Rivers and Harbors. As Colonel Max Tyler, who is to succeed Major Edgerton as chief engineer, as already announced in the ELECTRICAL WORLD, will not be able to take over the position until the middle of August, Major Edgerton will not assume his new duties at West Point until August 24.

NEWELL A. CLARK, for two and a half years manager of the Fall Mountain Electric Company, Bellows Falls, Vt., has been transferred by the New England Power Association to Providence, R. I., effective April 1, where he will be assistant to the general manager of the Narragansett Electric Company. E. F. LEACH, formerly of the Narragansett company and lately assistant manager of the Fall Mountain company, will succeed Mr. Clark at Bellows Falls.

Obituary

MYRON T. HERRICK of Cleveland, United States Ambassador to France, whose death on March 31 caused national mourning in both countries, had been connected with the electrical industry through very liberal investments made in 1906, in association with others, in organizing the Central Colorado Power Company, now merged in the Public Service Company of Colorado. The Central Colorado Power Company built two hydro-electric plants — the Shoshone plant at Glenwood Springs and the Boulder plant.

HORACE J. COCHRAN, who had been prominently identified with the industrial life of Maysville, Ky., died suddenly March 13 in his fifty-second year. At the time of his death Mr. Cochran was president of the January & Wood Company, the Maysville Water Company, the Security Bank & Trust Company and the Maysville & Aberdeen Bridge Company. He was president of the Maysville Public Utilities Company prior to the sale of the properties to the Kentucky Power & Light Company about three years ago.

GEORGE HALE BARRUS, for many years a consulting engineer specializing in steam-plant practice, with headquarters at Boston, Mass., died at his home in Brookline, Mass., on April 3. He was born at Goshen, Mass., in 1854, was educated at the Massachusetts Institute of Technology, and for a few years before entering private practice was an assistant in the steam engineering laboratory. He was a writer of distinction on professional topics.

W. L. MOUNTS of Carlinville, Ill., a lawyer and public utility man, died at his home in that city February 5, after a long illness. Mr. Mounts was one of the pioneers of the electric and gas industry in Illinois. In 1889 he took charge of the Carlinville coal-gas plant and under his management electrical equipment was installed. He operated the plant until 1912, when it was sold to the Madison Light & Power Company.

WILLIAM E. DAVIS, electrical engineer at the Goodall Mills, Sanford, Me., for 30 years, died March 4 at the Goodall Memorial Hospital from injuries sustained when a machine exploded. Mr. Davis was a native of Sunapee, N. H., and was 64 years old. He received his early education at the Kimball Union Academy and then devoted his attention to the engineering profession. He had served in an engineering capacity with the Houston Electric Company, the Hawkes Electrical Company, Boston, Mass.; the Lewiston-Auburn (Me.) Electric Light Company and the American Electric Heating Corporation.

Financial and Statistical News

SHARING the weakness and uncertainty characteristic of all the security markets recently, the power and light stocks have reacted steadily from the year's high marks. Several leading issues show wide losses from the top. American & Foreign Power, for example, was down about 50 points, American Superpower A 34, Electric Investors 30, American Power & Light 25, Middle West Utilities 24, Commonwealth Power 18 and Consolidated Gas 18 from the year's high, early this week.

——THE BANKS have been making heavier withdrawals from the call loan market than for some weeks. Member banks, still heavily indebted to the Federal Reserve banks, are attempting to reduce these obligations and at the same time meet the growing commercial demand for funds. This limits the amount available for market operations, with the result referred to in the first paragraph.

——ANOTHER INDIRECT EFFECT of the same cause is the scarcity of new public issues. Practically none have come forward this week. Rights were announced during the week by a few of the companies, such as Portland Electric Power, General Gas & Electric and International Paper & Power.

Utilities Power & Light Simplifies Structure

The Utilities Power & Light Corporation has perfected plans for the elimination of the Laclede Gas & Electric Company as the holding company for the Laclede Gas Light Company and the Laclede Light & Power Company of St. Louis, Mo. The securities of the Laclede Gas & Electric Company are to be retired out of the proceeds of the new issue of $36,000,000 5 per cent debentures of the Utilities Power & Light Corporation.

Under the new plan the Utilities Power & Light Corporation will become the direct holder of the 53,000 shares of common stock of the Laclede Gas Light Company instead of holding this stock in a subsidiary. The new issue of debentures will retire the 200,000 shares of the Laclede Gas & Electric Company's common stock and $4,700,000 of 7 per cent bonds, $1,000,000 of 7 per cent prior-lien preferred stock and about $1,250,000 of 7 per cent preferred stock.

State Line Generating Company Issue

In a petition filed with the Indiana Public Service Commission the State Line Generating Company, an Insull company, now engaged in the construction of a $35,500,000 power plant in Lake County, asked authority to issue $7,000,000 in two-year 5 per cent notes with which to repay loans and to provide additional construction money. The notes, the petition said, are to be sold at not less than 96 per cent of par. The new plant, when completed, will supply electric current for the Northern Indiana Public Service Company and the Interstate Public Service Company of Indiana and the Commonwealth Edison Company and the Public Service Company of Northern Illinois, all Insull enterprises. Thus far, the petition sets out, $18,811,000 has been spent in construction of the plant, which is on the shore of Lake Michigan.

Canadian Power Investment Almost a Billion

Canadian consumption of electrical energy in 1928 increased 16 per cent over that of the previous year, according to figures compiled and just issued by the Royal Bank of Canada. In 1927 there has been an increase of 14 per cent as compared with 1926. The same general rate of increase was shown in Ontario and Quebec as in other parts of Canada, but the fact that about 80 per cent of the total turbine installation of the country is found in these two provinces makes the 16 per cent increase in this area particularly significant.

The growth of the capital investment in this industry has been proportionate to the growth in energy production and the total investment is now estimated as being close to one billion dollars. In this respect the power industry is now ahead of all other Canadian industries. Between 1910 and 1928 the volume of investment in the electrical industry increased from $121,000,000 to $900,000,000. The plants now under construction call for further investment of about $200,000,000 for construction, machinery, transmission and distribution.

General Gas & Electric Rights

Rights to acquire additional stock are being offered to the common-stock holders of General Gas & Electric Corporation. A recapitalization is discussed which will provide for a split-up of the common shares.

Holders of class A and class B stocks and dividend participations are to receive the right to subscribe to additional class A shares at $70 a share on the basis of one class A share for each three shares of class A or class B stock or each three dividend participations held on April 15, 1929. Subscription privileges expire May 1. The present issue has been underwritten.

Maryland Growth Rapid in Electrical Service

If the expansion of electric service in Maryland continues the way it went forward last year it will be only a comparatively short time before every community of any size in the state will be receiving this electric service, according to the Maryland Public Service Commission. The commission has made its annual report covering last year and it includes many interesting statistics. The last year, the commission says, has seen the extension of electric service into sections of the state, particularly in southern Maryland, where heretofore such service has not been available.

The commission had 67 electric light companies and seven gas and electric companies under its jurisdiction last year. The 67 light companies had capital stock of $33,025,678, funded debt of $53,848,759 and total capitalization of $86,874,437. The interest on the funded debt was $694,165 and the dividends declared on capital stock totaled $1,659,492. The seven gas and electric companies had capital stock of $53,960,499, funded debt of $91,343,400 and total capitalization of $145,303,899. Interest on the funded debt was $3,184,959 and dividends declared on capital stock totaled $4,043,957.

Some interesting information as to interruptions in service is presented. Thirty-eight companies showed a total of 8,316 community interruptions, the number of communities served totaled 523 and the total duration of the interruptions was 1,890 hours. Interruptions to power supplied to street railway companies totaled 21 hours and 22 minutes.

Investment Houses Merge

Announcement has just been made of the consolidation of E. H. Rollins & Sons and Howe, Snow & Company, investment bankers. Both organizations have been active for many years in public utility financing. The business will be conducted under the name of E. H. Rollins & Sons.

With this merger of interests, E. H. Rollins & Sons will have increased capital and facilities to do a broader business in financing. It is intended to continue the various lines of business in which the two organizations have been engaged, and through associated

Companies, the new organization will have substantial interests in the ownership of a number of important public utility and industrial companies.

American & Foreign Power May Get Shanghai Contract

Cables have just been received from Shanghai by the American & Foreign Power Company, Inc., advising that the advisory committee of the City Council of the International Settlement has investigated the bids recently made for the electric power and light system owned by the International Settlement and serving the foreign city of Shanghai and a part of the surrounding territory and the City Council has recommended to the taxpayers that the bid of the syndicate led by the American & Foreign Power Company, Inc., be accepted. The taxpayers are to vote on the question on April 17 and in view of the recommendation of the City Council it is expected that the bid of the American & Foreign Power Company, Inc., interests will be accepted. The taxpayers who vote on the question are foreign residents who own property in the territory controlled by the International Settlement.

Cities Service Company to Vote on Issue

Cities Service Company stockholders at their annual meeting April 30 will vote on the issue of 1,000,000 shares of 5 per cent non-cumulative preferred stock at $1 par value. The stock is to be sold by Henry L. Doherty & Company at par. Since each share of the new stock will carry full voting power it will insure control of the Cities Service Company to Doherty & Company. The present common stock has one-fifth of a vote per share. Doherty & Company, in addition to acquiring the million shares, will have an option to purchase any additional stock which may be voted by the shareholders.

Czechoslovakia Produced 1,900,000,000 Kw.-Hr.

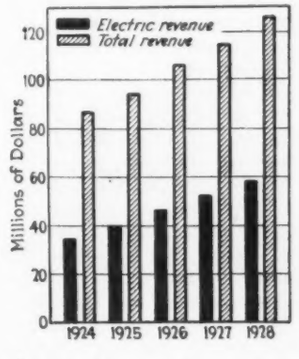
Czechoslovakia's electrical energy output in 1928 is estimated at 1,900,000,000 kw.-hr., according to the decennial anniversary jubilee report of the Czechoslovak Electric Association. Complete statistics are not yet available. The same authority shows that there has been a rapid growth in the country's electrification. In millions of kilowatt-hours the production in recent years was: 1922, 976; 1924, 1,150; 1925, 1,300; 1926, 1,511; 1927, 1,700. The values for 1924 and 1927 are partly estimated.

The returns include industrial and mining plants as well as those for light and power. The total in 1928 was equivalent to 140 kw.-hr. annually per capita of population. The trend, under the electrification law of 1919, is to combine all electric works into a co-ordinated national system, and under a centralized authority to expand electrical operation by the construction of large plants and a comprehensive transmission system. A distinction has been established between so-called public utility companies, which are required to give service to all applicants within their territory, and other establishments, although as a matter of fact many of the latter sell energy to the public. These public utilities in 1927 generated 379,849,000 kw.-hr., had an output (including purchased energy) of 438,120,000 kw.-hr., sold 380,045,000 kw.-hr., and had 278,118 kw. of plant and 12,471 km. (7,750 miles) of high-tension lines. Share capital was 381,427,000 kr., total investment 1,347,305,000 kr.

Public Service Corporation of New Jersey Shows Fourfold Increase in Surplus

INCREASING its gross revenue by almost 10 per cent to $125,528,580, Public Service Corporation of New Jersey showed a surplus after holding company dividends almost four times as great as that of the previous year. The net increase in surplus last year was $5,107,569. This represents earnings of about $3.29 a share on the common stock outstanding at the end of the year, against $2.21 in 1927 and $2.44 in 1926.

During the year the number of kilowatt-hours of electricity sold, exclusive of current furnished for the operation of the railway lines of Public Service Co-ordinated Transport, amounted to 1,406,258,947, which is an increase of 13.96 per cent over the amount sold in 1927. The sale of electric and gas appliances brought in a revenue of $6,119,089, which is approximately 7 per cent greater than the total for the previous year. This increase in electric sales is due almost entirely to the increase of population and the growth in electricity used within communities already served, largely resulting from sales efforts. Commercial metered lighting sales for the year amounted to 468,158,285 kw.-hr., which is an increase of 13.37 per cent. During the year the company itself sold and installed 4,825

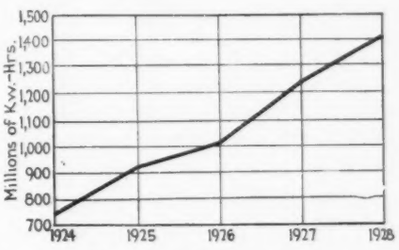


Comparison of the sources of revenue

refrigerators. Motor-driven labor-saving appliances, such as vacuum cleaners and laundry equipment, still hold first place in appliance sales.

Net expenditures during the year for extension and improvements of the facilities of the corporation and its subsidiary utility companies, charged to fixed capital, after deduction of capital items withdrawn from service, amounted to $36,279,617. Plant and equipment are now fully capable of meeting the demand for service, which was materially increased during the year.

It is interesting to note that during 1928 the Public Service Corporation of New Jersey ended the first 25 years of its corporate existence. Comparing the



Five years' growth in power output

records of the twelve months ended December 31, 1904, which constituted the corporation's first full year of operation, and those for the year ended December 31, last, shows a picture of remarkable growth. A comparison shows the following increase over the period:

An increase of $108,378,737 in annual operating revenues.

An increase of 1,363,742,157 kw.-hr. in the annual sale of electricity.

An increase of 18,706,019,000 cu.ft. in the annual sale of gas.

An increase of 427,734,181 in the number of passengers carried during twelve months.

An increase of 820,646 in the number of electric and of 530,768 in the number of gas meters on Public Service lines.

Manitoba Power Report

The annual report of the Manitoba Power Company, Ltd., for the year ended Dec. 31, 1928, reveals an increase in gross earnings to the best level in the history of the company and a strengthening in the balance sheet position. Gross earnings for the year amounted to $1,218,266, as compared with $1,002,290 in 1927. Deduction of operating expenses at $175,608 left net operating income at $1,042,658, while the addition of miscellaneous income at $77,467 left gross income at $1,120,125, as against $876,784 in the preceding year. Deduction of interest charges at $630,909, taxes at $56,242, other de-

ductions at $34,366 and dividends at $374,637, left a surplus of $23,971, as against $31,109 in 1927. Previous surplus was brought forward at $48,989, making total surplus in the current report of $72,960.

Increased Use of Power in Laundries

Commercial power laundries in the United States increased their installed horsepower by 27.3 per cent in the two-year interval from 1925 to 1927, according to a recent bulletin of the Department of Commerce. It rose from 263,598 to 335,578 hp. How much of the increase was electric the preliminary report does not state. In 1925 79,421 hp. was operated on purchased electrical energy and 51,000 hp. on energy generated in the establishment reporting; the generating capacity of the latter was 54,608 kw.

The increase in horsepower was greater than in any other item listed. The amount received for work done rose 25.3 per cent to $453,877,518. In number of employees, 221,043, the industry approaches the central-station industry, which probably has about 285,000.

WATER POWERS OF CALIFORNIA.—The Federal Power Commission announces the practical exhaustion of its stock of copies of the report on the water powers of California, compiled by District Engineer Bonner, U. S. Forest Service, but states that copies may still be purchased of the Superintendent of Documents, Government Printing Office.

VIRGINIA UTILITY TO INCREASE STOCK.—Stockholders of the Virginia Electric & Power Company at their annual meeting on April 17 will vote on proposals that the authorized capital stock be increased from 480,000 to 580,000 no-par shares and that provisions in the charter that the preferred stock should not be redeemed until after three years from the date of issue be stricken out with respect to preferred stock to be issued in the future, but not to preferred stock now outstanding.

SIERRA & SAN FRANCISCO POWER COMPANY TO FLOAT BOND ISSUE.—Authority has been granted by the California Railroad Commission to the Sierra & San Francisco Power Company, a property of the Pacific Gas & Electric Company, to issue and sell on or before July 31, 1929, at not less than 99 per cent of face value, plus accrued interest, $500,000 of first mortgage 5 per cent gold bonds, due August 1, 1949, and to use the proceeds for the purpose of financing, in part, construction expenditures.

ESTIMATES 3,000,000 ELECTRIC RADIO SETS.—Radio is rapidly attaining the magnitude of a billion-dollar industry, Bond P. Geddes of New York City, executive vice-president of the Radio Manufacturers' Association, declared recently at the annual convention of the Federated Radio Trade Association. Sales of radio products last year reached the peak of $650,000,000, more than ten times those of 1922, while manufacturers are planning to increase their output this year from 20 per cent to 50 per cent. Six years ago the radio audience was about 75,000 persons, while the American audience today is over 40,000,000. There are 28,000,000 homes in the United States. Of these about 9,000,000 have radios of some sort, variety or description, but of these 9,000,000 homes less than one-third, it was stated, have modern electric radios.

COLUMBIA GAS & ELECTRIC INCREASES STOCK — Shareholders of the Columbia Gas & Electric Corporation last week approved an amendment to the certificate of incorporation increasing the common stock from 4,000,000 shares to 10,000,000 and providing for the immediate issuance of 2½ shares of the new stock for each share of common stock outstanding.

Forecasts Power Shortage in New Brunswick

The ninth annual report of the New Brunswick Electric Power Commission states that a total of 26,053,900 kw.-hr. was distributed to regular customers last year, this being an increase of 17.25 per cent over the previous year. The report hints at the importance of additional power being made available at the earliest possible date and announces preliminary plans for the building of a modern auxiliary fuel plant.

A tremendous increase in the demand for electrical energy from the service of the commission is forecast, the report predicting that whereas more than 26,000,000 kw.-hr. were distributed last year, a total of not less than 60,000,000 kw.-hr. will be needed by 1937 and, with present facilities, the commission is not in a position to supply this. With the present rate of increase in demand, the commission predicts that a crisis will be reached this year unless additional sources of energy are provided.

Rights Issued to Shareholders of International Paper & Power

RIGHTS have been issued to common-stock holders of International Paper & Power Company to subscribe to class A stock of International Hydro-Electric System. For each ten shares of common stock of International Paper & Power Company, whether class A, class B or class C, of record at the close of business April 8, 1929, stockholders may subscribe to one share of class A stock of the system at $43 a share. This subscription right also extends to the holders of part-paid subscription receipts for class C common stock of International Paper & Power Company.

International Hydro-Electric System is a new company formed as a subsidiary of International Paper & Power Company to control the principal electric power organizations identified with the company. International Hydro-Electric System will own directly over 82 per cent of the outstanding common stock of New England Power Association and the entire common and second preferred stocks of Canadian Hydro-Electric Corporation, Ltd. Through these subsidiaries the system will control one of the largest groups of hydro-electric properties in the world under one ownership.

Class A stock of the system carries a cumulative preferential dividend of $2 per share a year, and in addition is entitled to equal participating rights as a class with the class B and common stocks taken together as a class. Under the announced current policy, however, stockholders may, at their option, take their dividends in class A stock at the rate of 8 per cent a year.

The operating subsidiaries of Canadian Hydro-Electric Corporation, Ltd., have entered into long-term contracts with the Hydro-Electric Power Commission of Ontario and others requiring delivery of primary power in the aggregate increasing to more than 480,000 hp., beginning October 1, 1931, of which 248,000 hp. is now being delivered. In addition, surplus power is being sold to Canadian International Paper Company under a contract which can be canceled in whole or in part as the power is sold for other purposes.

PORTLAND ELECTRIC POWER COMPANY ISSUES RIGHTS—Stockholders of the Portland Electric Power Company have been notified that the company proposes to change the value of its common stock from $100 par to no par. Rights are being issued to shareholders to subscribe to one additional share for each three shares previously held at the price of $31.50 a share. Rights will include the stockholders on record as of April 13.

ITALIAN SUPERPOWER ISSUES FIRST REPORT.—The Italian Superpower Corporation, organized early in 1928, reports for the first year of operation covering the period from January 31 to December 31, 1928, net operating earnings after all expenses and taxes of $2,285,582, equivalent to more than twice the interest requirements on its debenture bonds. After payment of preferred dividends a surplus of $488,886 remained for the period. The balance sheet as of December 31 showed total assets of $36,199,599, represented principally by stocks carried on the books at $32,644,799, Italian government bonds carried at cost, $985,107, and cash and call loans of $2,559,720.

Business News and Market Conditions

$8,500,000,000 for New Construction During 1929

Approximately $8,500,000,000 will be expended for new construction and for repairs and replacements in the building field during 1929, according to statistics just compiled by the Copper and Brass Research Association in its annual building survey. This large total exceeds by about half a billion dollars the building expenditures of 1928 and establishes a new high record for all time.

The survey groups buildings into two classes: (1) Buildings which become obsolete and are abandoned after a determinable average life and (2) buildings such as government buildings, churches, museums and many other public, industrial, commercial, religious and recreational buildings and housings which, because of original quality of construction or better maintenance, serve beyond the period fixed as average for buildings in the first group.

Using these divisions the construction requirements for 1929 are estimated as shown in the accompanying table.

	Millions of Dollars
Group 1	
Housings (363,000) to care for a population increase of 1,650,000	$1,533
Other construction to accommodate a population increase of 1,650,000	1,227
Replacement of buildings destroyed by fire or storm	500
Replacement for obsolescence at 1.66 per cent per year (60-year basis for group 1)	2,122
Maintenance (recorded contracts for alterations and repairs)	1,242
	$6,624
Unrecorded maintenance	1,242
Total for Group 1	$7,866
Group 2	
Obsolescence, estimated at 2 per cent	$280
Maintenance, estimated at 2.5 per cent	350
Total for Group 2	$630
Total building requirements for 1929	$8,496,000,000

Manufacturing Industries Add Over 3,000,000 Hp.

In the two-year interval from 1925 to 1927 the installed horsepower in manufacturing industries in the United States increased by 3,265,070 hp. and at the end of 1927 amounted to 39,032,014 hp. This is shown in the recently published summary of the Census of Manufactures for 1927.

The summary does not classify the horsepower by type of prime mover, giving simply the total, but from past experience it is probable that most of the increase was in electric motors operated on purchased energy. Statistics on this point are not yet published.

As is evident from the subjoined abstract, no other item shows a per cent of increase as great as that of the installed horsepower.

Summary for Manufacturing Industries in the United States

	1927	1925	Per Cent Increase
Number of establishments	191,863	187,224	2.5
Wage earners (average for year)	8,351,257	8,381,511	—0.4
Wages*	$10,848,782,433	$10,727,337,625	1.1
Value of products†	$62,713,847,403	$62,668,259,591	†
Value added by manufacture	$27,585,792,755	$26,771,373,165	3.0
Horsepower	39,032,014	35,766,944	9.1

*Not including salaried employees.

†The comparability between the 1925 and the 1927 figures for value of products is somewhat affected by the fact that the manufacture of paper and wood pulp was treated as a single industry in 1925 and as two industries at the census of 1927. Hence no figure is given for percentage of increase.

Copper Leads Metal Price Declines

The non-ferrous metals bull market suffered a sharp relapse during the past week. Featured by the decline in copper prices, which amounted to nearly 5 cents per pound, the list in general showed a strong downward tendency. Lead prices closed the week 0.6 cent per pound below the level of a week ago.

NEW YORK METAL MARKET PRICES

	Apr. 3, 1929 Cents per Pound	Apr. 10, 1929 Cents per Pound
Copper, electrolytic	24	19.25
Lead, Am. S. & R. price	7.75	7.15
Antimony	9.625	9.50
Nickel, ingot	35	35
Zinc, spot	7.15	6.625
Tin, Straits	48.50	46.375
Aluminum, 99 per cent	24.30	24.30

Base copper wire price April 10, 1929, 25¾ cents

Sales of Brass Pipe

Sales of brass pipe reached the unprecedented total of 76,777,400 lb. in 1928, or almost five times the poundage sold in 1922, according to statistics just compiled by the Copper and Brass Research Association. The total for 1928 was approximately 14,000,000 lb. above the total for 1927, this being one of the largest gains in a single year since consumption of brass pipe assumed large proportions.

In 1922 sales were 16,016,500 lb., so that the total for 1928 represents a progressive increase to an additional 61,000,000 lb. in yearly consumption. On a percentage basis the gains over 1922 were 5 per cent in 1923, 61 per cent in 1924, 145 per cent in 1925, 234 per cent in 1926, 293 in 1927 and 379 per cent in 1928, or an average gain of 74.8 per cent annually since 1923.

N.E.M.A. Adds Two Divisions

Formal approval has been given by the executive committee of the board of governors of the National Electrical Manufacturers' Association to the organization of two new divisions—the wiring devices and roughing-in materials divisions—under the authority vested in the revised constitution.

The realignment of sections, or manufacturing industries, into new divisions will bring together those groups having similar interests and thus effect a greater co-ordination of association activities. Approval has been given to the organization of a wiring devices division composed of these sections:

Attachment plug section, fuse section, knife and inclosed switch section, lamp receptacle and socket section and the snap switch section.

The following N.E.M.A. sections have been organized as members of the roughing-in materials division:

Armored conductor and flexible metallic conduit, conduit fittings, electrical porcelain, metal molding, non-metallic conduit, non-metallic sheathed cable, outlet box and switch box, rigid conduit, wire and cable.

Electric Industrial Trucks and Tractors

March shipments of electric industrial trucks and tractors, as reported to the Department of Commerce by the eleven leading manufacturers in the industry, were 210, as compared with 134 in February and 129 in March, 1928.

Shipments of Electric Industrial Trucks and Tractors

1928	Total	—Domestic— Tractors	—Domestic— All Other Types	Exports
January	112	5	98	9
February	119	15	86	18
March	129	18	95	16
Three months	360	38	279	43
April	136	9	121	6
May	114	8	93	13
June	116	6	96	14
July	107	5	87	15
August	96	5	85	6
September	118	11	102	5
October	134	5	109	20
November	132	9	117	6
December	153	10	126	17
Total (year)	1,466	136	1,215	145
1929				
January	152	4	129	19
February	*134	10	121	3
March	210	14	186	10
Three months	496	28	436	32

*Revised.

Market Conditions

IN CERTAIN sections of the country higher prices and an element of uncertainty in business appear to have induced hesitancy in making further commitments in the equipment trades. In the East central-station business has fallen off sharply from last month and inquiries also are reduced.

——NEW ENGLAND reports industrial equipment orders well sustained and substation business is active in the Southeast.

——BOTH POWER STATION AND INDUSTRIAL BUSINESS in the Middle West continues somewhat better. Stock size motors are especially active in the St. Louis area.

——DAY-TO-DAY BUSINESS in most sections of the Pacific district continues on a satisfactory basis, although distribution transformer sales have fallen off. Business volume is satisfactory in the Puget Sound area.

Substation Equipment Leads in Eastern District

Substation account is a feature of the present demand in the Eastern district. Except for transformers and accessory equipment, central-station business exhibits a noticeable decline as compared with this time last month, not only with regard to gross amount of sales, but in connection with inquiries, which are showing appreciably lessened volume. Neither is the general market tone as satisfactory as a few weeks ago. Price advances have had a noticeable effect, and an under-current of uncertainty is making for hesitancy in placing commitments. A metropolitan power company has ordered a quantity of transformers from a New York maker to cost $100,000. A central station in Kentucky has given a contract for similar equipment to cost $110,000. A New York utility company has ordered transformers and accessories to cost $30,000. A Pennsylvania manufacturer has received an order from a metal refining company in Texas for a quantity of transformers and an electric sign manufacturer in northern New York has given a commitment for low-voltage transformer units to the sum of $80,000.

Switching equipment shows improved activity. A New York power interest has given a contract for switching equipment for a station in New Jersey, now in progress, to cost $25,000. A central station in Virginia has ordered a quantity of switching equipment from a Pennsylvania manufacturer to cost $50,000. Prime movers are securing but slight attention and business is slow in that direction. Transmission line equipment, including line hardware, etc., is showing a like course. Industrial business is exhibiting a tendency to lag. Orders are being recorded in reduced volume, and while inquiries are holding fair, there is a marked indication of deferring commitments until prices return to former levels. Fractional-horsepower units, however, are a bright spot in the situation. Refrigerator business is developing with a strong, steady tone and spring and summer sales are expected to show record proportions. Construction projects are as follows:

The New York Edison Company, New York City, plans extensions in its power plant at Fourteenth Street, to cost $1,000,000. The Crane Company, Chicago, will build a branch pipe and fitting plant at Utica, N. Y., to cost $90,000. The Foundation Company, New York, will make surveys for a hydro-electric power plant for the Government of Uruguay, near Montevideo, to cost $20,000,000. Kohn & Mundus, Inc., New York, will establish a furniture factory at Long Island City, to cost $100,000. The International Business Machines Corporation, Binghamton, N. Y., will make extensions in its plant at Endicott, N. Y., to cost $200,000. The Borst Engineering Company, Buffalo, will build an automobile equipment plant to cost $85,000. The R. G. Kittinger Shops, Inc., Buffalo, will build a furniture factory at North Tonawanda, N. Y., including a power plant, to cost $250,000.

The Pennsylvania Railroad Company, Philadelphia, will build a power plant and substation to cost $700,000. The Philadelphia Electric Company, Philadelphia, plans a substation at Bristol, Pa., to cost $60,000. The Raub Supply Company, Lancaster, Pa., will build a factory branch and distributing plant at Philadelphia, to cost $100,000. Pittsburgh, Pa., plans a floodlighting system and beacon lamps at its proposed airport to cost $1,000,000. The Pittsburgh Plate Glass Company, Pittsburgh, plans a sheet glass plant at Henryetta, Okla., to cost $2,000,000; and a similar plant near Santa Ana, Calif., to cost $1,500,000. The Jones & Laughlin Steel Company, Pittsburgh, plans a storage and distributing plant at Memphis, Tenn., to cost $200,000. The United Stainless Steel Corporation, Washington, Pa., will make extensions to cost $250,000.

Industrial Equipment Orders Increase in New England

Orders for industrial equipment are increasing in volume in the New England district. Switch and control equipment orders are keeping pace with small motor sales and negotiations for heavy power equipment are reported active. Industrial electric furnace inquiries are ahead of last year and central-station sales are gaining. Orders for a number of large motors were recorded, one 200-hp. unit, with accessories, was placed for a northern New England mill. Small motor sales, including one lot amounting to $2,000, and another of $4,200, reached over $45,000. Orders for control equipment are numerous and a mill in southern New England recently placed an order for power plant control amounting to $6,000, while another similar order for a mill in eastern Massachusetts amounting to over $3,000 is noted. Substation equipment business is encouraging, insulator sales are steady, outside control equipment is commanding attention and bids are in for considerable work to be done in the Northern districts. Linking up of transmission lines now planned presages many orders to be placed soon. Inquiries and negotiations for heavy power generating equipment are active and there are units being considered which total $1,500,000 receiving the attention of engineers in this district. Industrial electric furnaces are attracting attention among machine tool manufacturers and one manufacturer reports that units totaling 400 kw. were recently placed for early delivery. Construction projects are as follows:

Lever Brothers Company, Cambridge, Mass., plans a soap manufacturing plant at Hammond, Ind., to cost $4,000,000. The Boston Elevated Railway Company, Boston, plans a power substation to cost $30,000. The Pond's Extract Company, Clinton, Conn., will build an addition to cost $100,000.

Transformer Orders Placed in Southeast

Business in the Southeast is reported as very satisfactory, with general supply lines showing an increased movement. Transformer orders have been particularly good, in anticipation of price increases. The largest central-station order placed was for a 70,000-sq.ft. surface condenser for a Georgia company, while a Tennessee company ordered $125,000 in transformers and oil circuit breakers for a 25,000-kva. transformer bank. A Georgia company's orders for distribution and small power transformers aggregated $39,000, while an Alabama company ordered distribution transformers totaling $15,000. One company's wire orders were for $14,000 of steel wire, $4,100 of copper and $2,500 of guy wire. Some other central-station orders were for $7,800 worth of disconnect switches, $4,400 worth of creosoted pine poles and $2,000 in pole line hardware.

A paper mill in Alabama ordered varnished cambric lead-covered cable amounting to $40,000, while a tire fabric manufacturing plant in Georgia ordered $15,000 in house wiring materials for its mill village construction. A municipally owned distribution system in Georgia ordered $2,500 in distribution transformers, while another town in the same state ordered $1,000 in motors and transformers for the city pumping station. A third small town ordered $700 in parkway cable. Construction projects are as follows:

The Chesapeake & Ohio Railroad Company, Richmond, Va., will build an engine

house and repair shops at Clifton Forge, Va., to cost $200,000. The Virginia Table Company, Marion, Va., plans additions to cost $80,000. The Crozet Cold Storage Company, Crozet, Va., will build a cold storage and refrigerating plant to cost $175,000. Charlottesville, Va., plans a floodlighting system and beacon lamps at its proposed airport, to cost $70,000. The Brown & Williamson Tobacco Company, Louisville, Ky., plans an addition to cost $500,000. The Kentucky Electric Lamp Company, Owensboro, Ky., will build a plant to cost $65,000. Paris, Tenn., contemplates a municipal electric light and power plant to cost $100,000. Laurel, Miss., plans a floodlighting system and beacon lamps at its proposed airport, to cost $50,000. The Lamson & Sessions Bolt Company, Cleveland, plans a plant at North Birmingham, Ala., to cost $350,000. The Southern Cereal Company, Tarrant City, Ala., will build a mill to cost $115,000. The Toccoa Electric Power Company, operated by the Tennessee Electric Power Company, Chattanooga, Tenn., plans a hydro-electric power plant at Blue Ridge, Ga., to cost $4,000,000. The Goulds Tire & Rubber Company, St. Petersburg, Fla., plans a mill to cost $350,000.

Power Company Buying Features Pacific Business

Power company purchasing on the Pacific Coast features the week, including such orders as two carloads of 4-in. fiber conduit, one mixed carload of bolts and pole steps, $5,000 worth of No. 4/0 lead-covered cable, three-conductor, 500-volt, all for distribution from Oakland central warehouses, and two carloads of copper wire for the San Luis Obispo district, principally for a No. 1/0 transmission line, also four assorted carloads of sizes 35 to 45-ft. poles were shipped to the Napa district. State departmental buying is light and limited to small repair and maintenance material. The city of San Francisco is in market for three miles of No. 3/0 copper wire for its municipal street railroad. Oil company purchasing has improved, largely because of recent extensions of the Kettleman field near Coalinga, where several companies have holdings. Railroad buying has included train-despatching equipment over 350 track-miles and is expected to include shortly 5 miles of heavy lead cabling for terminal yards. The Federal telegraph has bought ten General Electric 20-kw. motor-generator sets totaling $50,000 for installation in Palo Alto and elsewhere. The city of Seattle bought fire department electrical apparatus, including relay boards, circuit protector board units, etc., costing in excess of $20,000 and will shortly take bids for about $20,000 worth of weatherproof wire and $15,000 worth of small distribution transformers. An ordinance proposing a $13,000,000 bond issue for a dam at Hanging Rock and another hydro-electric development in connection with a municipal lighting and power project was introduced in the Seattle City Council. Sand Point, Idaho, voted favorably on a $300,000 bond issue for a municipal power plant, the initial work to start within 60 days. The Peoples West Coast Hydro-Electric Corporation, Portland, Ore., plans the expenditure of $10,000 in line work near Shelton, Wash., and the Grays Bay Electric Light & Power Company, was organized to build a power plant and system to serve the Deep River, Wash., Roseburg, Ore., and Grays River, Wash., districts. A contract for an $18,000 street lighting system was let by the town of Port Angeles, Wash. Construction projects are as follows:

The Water and Power Bureau, Los Angeles, will receive bids until April 25 for power transformer requirements for one year, (Adv. No. 12). The Union Oil Company, Los Angeles, plans an oil refinery in the Wilmington, Calif., district, to cost $1,000,000. The Union Ice Company, San Francisco, will build a cold storage and refrigerating plant at Santa Cruz, Calif., to cost $50,000. The Pacific Telephone & Telegraph Company, San Francisco, will build an equipment storage and distributing plant at Emeryville, Calif., to cost $70,000. Los Angeles, Richmond, Huntington Beach and Monterey, Calif., plan ornamental lighting systems. The Southern California Edison Company, Los Angeles, plans a steel tower 33,000-volt transmission line in Los Angeles National Forest. The Puget Sound Power & Light Company, Seattle, Wash., plans a switching station at Renton, Wash., to cost $1,000,000.

Stock Size Motors Prominent in St. Louis District

Representatives of three large manufacturers in the St. Louis district made the statement that the volume of sales of stock sizes of motors in the last ten days has been greater than that of the previous three months. The rise in prices of metals has resulted in a marked activity in the lead and zinc fields of this district. One lead company in Southeast Missouri placed an order for compressors to be used in connection with a flotation process and costing $22,000. Another company purchased a lot of motors motor-generator sets and transformers to cost $25,000. The only other order of contract size reported was for 25 vertical hollow-shaft pump motors to cost $15,000 for use in the rice fields of Arkansas. Construction projects are as follows:

The Independent Stove & Furnace Company, Independence, Mo., will build an addition to cost $65,000. The Broderick & Bascom Rope Company, St. Louis, plans an addition to its wire rope plant to cost $140,000. The Nicholas-Beazley Airplane Company, Inc., Marshall, Mo., plans an addition to cost $70,000. The Coleman Lamp Company, Wichita, Kan., will build an addition to cost $70,000. The International Harvester Company, Chicago, will build a factory branch and distributing plant at Dodge City, Kan., to cost $150,000. The Cessna Aircraft Company, Wichita, Kan., plans an addition to its airplane manufacturing plant to cost $130,000. The Public Service Company of Oklahoma, Tulsa, Okla., will build a transmission line to Watts, Okla., and vicinity, to cost $250,000. Miami, Okla., has authorized bonds for $25,000, for an ornamental lighting system. The Empire Oil & Refining Company, Tulsa, Okla., plans a refining plant at East Chicago, Ind., to cost $10,000,000. The Southwestern Transportation Company, an interest of the St. Louis & Southwestern Railway Company, Tyler, Tex., plans an engine house and shops at Texarkana, Tex., to cost $200,000. Georgetown, Tex., plans a floodlighting system and beacon lamps at its proposed airport. The Firestone Tire & Rubber Company, Akron, Ohio, will build a factory branch and distributing plant at Houston, Tex., to cost $175,000.

Industrial Business Improves in Middle West

General business in the Middle West section continues to show improvement. The major activities, steel, automotive, agriculture and railroad industries, are in excellent shape, with an increased production in most industrial lines. The various railroads continue the purchasing of equipment, the Northern Pacific Railroad ordering 500 gondolas, the Chicago & Northwestern accepting proposals for 72 suburban coaches and the Pacific Fruit Express 1,000 underframes for refrigerator cars. Car loadings were well diversified and show an increase over the previous week. Figures just made public of the shippers' regional advisory board forecast an increase in commodity movements of 9 per cent in the second quarter for the Great Lakes region. The utility companies are busy with spring construction work, a large amount of line extension is going on and several contracts for street work valued at $200,000 are being placed this week. Jobbers' sales continue satisfactory. There has been a good demand emanating from railroad and municipal sources, with a slightly decreased demand from the building industry. One of the large lumber companies is in the market for 300,000 lb. of triple braid weatherproof wire, 250,000 ft. of 25 per cent Para rubber-covered wire and a quantity of electrical merchandise for one of its Western plants. Construction projects are as follows:

The Kimberly-Clark Company, Neenah, Wis., contemplates a pulp and board mill at Park Falls, Wis., to cost $200,000. The Wisconsin Power & Light Company, Madison, Wis., will build an equipment storage and distributing plant at Janesville, Wis., to cost $35,000. The Sanitarium Equipment Company, Battle Creek, Mich., plans expansions to cost $200,000. The Beebe Bolt Works, Inc., Port Huron, Mich., plans a plant to cost $50,000. Niles, Mich., plans a floodlighting system and beacon lamps at its municipal airport, to cost $100,000 and Pontiac, Mich., plans a similar installation. Lansing, Mich., plans extensions in its municipal light and power plant, to cost $325,000. The Federal-Mogul Corporation, Detroit, will build an addition to its die-casting plant to cost $60,000. The Consumers Power Company, Jackson, Mich., plans an equipment storage and distributing plant at Battle Creek, Mich., to cost $200,000. The Continental Steel Corporation, Kokomo, Ind., will build an addition to cost $150,000. The Indianapolis Power & Light Company, Indianapolis, Ind., plans a power plant to cost $600,000. The Spicer Manufacturing Company, Toledo, Ohio, plans an addition to cost $250,000. The Mosby Medicine Company, Cincinnati, Ohio, will soon take bids for an addition to cost $400,000. Watertown, S. D., will make extensions in its municipal light and power plant, to cost $150,000. Hutchinson, Minn., plans a municipal light and power plant.

Activities of the Trade

Babcock & Wilcox Get New York Edison Order

Matthew S. Sloan, president of the New York Edison Company and companies associated with it in supplying electric service in Metropolitan New York, announced the closing of a contract with the Babcock & Wilcox Company for two new boiler units for the Hell Gate generating station of the United Electric Light & Power Company.

Each boiler unit consists of twin Babcock & Wilcox boilers, superheaters, economizers and air heaters. The boilers will supply steam to drive one of the 160,000-kw. (215,000-hp.) turbo-generators now being installed. Each will supply a maximum of 800,000 lb. of steam per hour at a temperature of 725 deg. F. at 275 lb. pressure per square inch. The furnaces will be equipped with Bailey water walls throughout and will be of the slag tap design.

The boilers will be fired by pulverized coal, six burners for each boiler, and each boiler will be equipped with four pulverizing mills. The consumption of coal will be at the rate of approximately 40 tons an hour, or nearly 1,000 tons a day for each boiler when operating continuously at its maximum.

Lincoln Electric Expands Welding School Facilities

The welding school maintained by the Lincoln Electric Company, Cleveland, is expanding its facilities to meet the rapidly increasing demand for practical instruction in arc welding. While students of the school are carefully selected as to the seriousness of purpose, it will probably be necessary to more than double the amount of welding equipment before the end of the current year. There is a waiting list of constantly increasing length and it is to take care of the urgent demand by manufacturers for more skilled arc welders that the present expansion is being made.

Canadian General Electric Reports Increased Business

The annual report of the Canadian General Electric Company, Ltd., for the year 1928 indicates that the company participated in the general prosperity experienced throughout Canada last year and had a successful and record year. The volume of business materially increased and unfilled orders at the end of the year were 16 per cent greater than at the beginning of the year. Net profits after reserves, taxes and depreciation were $3,694,665, compared with $2,103,053 in 1927. The sum of $599,042 was distributed in dividends on the preference stock, leaving a surplus of $3,095,625, amounting to over $16 per share on the common stock of $50 par value. From this amount is deducted a special appropriation of $2,865,871 for reduction of plant and property values, leaving the sum of $229,752 added to surplus, which now stands at $3,204,625.

Frigidaire Corporation Holds Sales Convention

The Frigidaire Corporation held a successful Pacific Coast regional sales convention in San Francisco on March 15, attended by approximately 800 members of the sales organization from Los Angeles, San Francisco, Oakland, Seattle and Portland. The convention was conducted by officials from the Frigidaire headquarters in Dayton, Ohio. R. F. Callaway, vice-president and assistant general manager of the company, reported that 1928 Frigidaire sales in the Pacific Coast territory were 30 per cent higher than 1927 sales.

Montan Treating Company Enters Pole-Preserving Field

The Montan Treating Company, a wood preservation organization which began operations in a plant at Westboro, Mass., last January, has extended its activities into the pole-treating field. J. Gardner Coolidge, 2d, vice-president, states that the Edison Electric Illuminating Company of Boston has placed an order for the full-length treatment of 1,000 Southern pine poles with the patented Montan creosote process, in which from 6 to 8 lb. of preservative per cubic foot are forced into the wood, using 60 per cent of Montan wax and 40 per cent of creosote. Licenses to use this process have been negotiated by the Pensacola (Fla.) Creosoting Company, Inc., and the Gulfport (Miss.) Creosoting Company. The Montan plant at Westboro is now operating a treating cylinder 100 ft. long by 8 ft. inside diameter, with a capacity of over 600 railroad ties, and is handling a ten-year contract with the Boston & Albany Railroad. Plans are afoot to utilize this plant, which is on a 50-acre site, as a pole treatment and storage center available to New England utilities. The headquarters are at 141 Milk Street, Boston, with a research laboratory at Brookline, Mass.

THE QUIGLEY FURNACE SPECIALTIES COMPANY, INC., 26 Cortlandt Street, New York City, announces the appointment of Captain M. F. Behar as advertising manager of its company. Captain Behar was formerly with the C. J. Tagliabue Manufacturing Company, Brooklyn, N. Y., as advertising manager.

American Bosch Magneto Earnings Rise Sharply

Sales of the American Bosch Magneto Corporation for the calendar year 1928 jumped almost 70 per cent to a total of $13,446,178, against $7,975,027 for 1927. The report shows profits of $1,040,255, against $469,174 for the previous year, which is a gain of more than 121 per cent.

The balance sheet of the company as of December 31 showed total assets of $10,143,873. According to President A. T. Murray, "During 1928 the corporation reduced its current indebtedness $1,679,232, which resulted in its being entirely free from bank loans at the year end and was in addition discounting all of its merchandise bills." Mr. Murray added: "Since January 1, 1929, the business of the corporation has shown a very substantial increase as compared with the corresponding period of last year, sales in January, 1929, having been approximately 35 per cent larger than for the like month of 1928."

THOMAS E. MURRAY, INC., 88 Lexington Avenue, New York City, designing and consulting engineer, announces the opening of a branch office at 2702 Eaton Tower, Detroit, Mich., with G. H. Kuechler in charge.

THE EAGLE ELECTRIC MANUFACTURING COMPANY, 59 Hall Street, Brooklyn, N. Y., manufacturer of electrical specialties, announces a new waffle iron.

PASS & SEYMOUR, INC., Solvay Station, Syracuse, N. Y., manufacturer of porcelain and electrical supplies, announces the appointment of Stanley D. Whitford as its district sales manager with headquarters in Chicago.

ROYAL WARRANT FOR THE HOOVER CLEANER.—By command of his Majesty the King of Sweden, Hoover, Ltd., London, the European branch of the Hoover Company, has been appointed the supplier of electric cleaners to the royal household. This is an honor which is eagerly sought and the royal warrant of appointment is given only after years of proved satisfactory service and is made to only one concern in its line of trade. This appointment is perhaps especially significant since Sweden is a country of expert engineering talent and since that country also is the home of the largest electric cleaner manufacturer in Europe.

THE WISCONSIN ELECTRIC COMPANY, Racine, Wis., manufacturer of portable electric grinders, drill machinery and electric motors, announces that it has changed its name to the Dunmore Company, Inc.

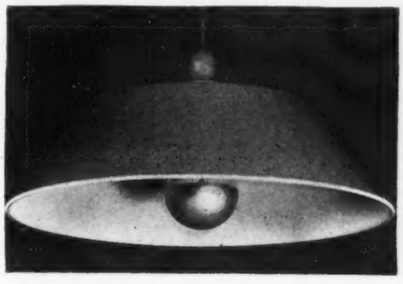
THE CLEVELAND TRENCHER COMPANY, Cleveland, manufacturer of trenching machinery, announces the appointment of A. V. Jones as its general manager. Mr. Jones was until recently merchandise sales manager for the Buffalo General Electric Company, with which he has been associated for the past twenty years.

New Equipment Available

Indirect Lighting Units

A new line of industrial lighting units said to be a long step forward in industrial illumination has been brought out by the Silvray Company of New York City, manufacturer of the Silvray system of indirect lighting. The factor of glare has been entirely overcome, it is said, and the illumination is said to parallel that of natural daylight closely. The term given to the new equipment is "controlled indirect light."

The unit consists of porcelain enameled steel reflectors of large diameter



with a special reflecting finish used in conjunction with the Silvray indirect lamp. The lamp has its lower portion silvered to about maximum diameter, which makes it impossible for direct light to reach the eye.

Floodlighting Projectors of New Design

A new line of projectors designed for use in the floodlighting of office buildings, hotels, banks, stores, theaters and all places where floodlighting is desired is introduced by the General Electric Company. The projectors, it is stated, have non-ferrous and hence non-rusting casings. The glass reflectors and lamps are totally inclosed so that dust and dirt cannot enter or impair efficiencies. Since the casing is non-ferrous, good heat radiation and minimum dimensions of design are afforded and the units are light in weight. Ease and accuracy in focusing are claimed through the use of unique universal focusing mechanisms. A small three-point base design and swivel give simple and economical mounting with ease of installation and orientation of the floodlight beam, it is stated.

The projectors are built with a formed, single-piece sheet copper casing and a single-piece door of the same material.

The type L29 projector, designed primarily for use with the 250-watt floodlighting lamp, is small in size and is particularly adapted for mounting in places where the available space is limited. It is equipped with a medium angle parabolic reflector and is suitable for working distances of from 85 to 200 ft. The paraboloidal reflector is 10 7/8 in. in diameter and gives a medium angle beam of approximately 12 deg. The asymmetrical reflector produces a wide angle beam. The lens diameter is 11¼ in. A universally adjustable swiveled crowfoot base of cast bronze is employed.

Grinder for Die Makers

A small, high-speed electric grinder, particularly suited to the needs of the die maker but also useful to platers and polishers and others who use small grinding and polishing wheels, is announced by Forbes & Myers, electrical manufacturers, Worcester, Mass.

The grinder is operated by the high-frequency system. This system requires one more motor than the grinding spindles, the additional motor being used as a frequency changer to supply the high-frequency current. The current is first changed by the frequency-changing motor to 420 cycles, which in turn operates the two-pole motors at 25,000 r.p.m. and four-pole motors at 12,500 r.p.m.

Adhesive Tape for Convenient Splices

A new type of insulating tape with adhesive gum on one side and a fabric finish which is not sticky on the other has been brought out by the General Sales Products Company of Atlanta, Ga., under the name of "2-plex" tape. Only one ply is necessary. The tape makes a neat joint, is self-vulcanizing and saves labor and material, according to the producers. The new tape is particularly recommended for the envelope joints by merely looping "2-plex" through the crotch and using slight pressure of the fingers. A neat, compact envelope joint may be secured through which the wire point will not penetrate.

THE NEW "TUEC SANITATOR," manufactured by the United Electric Company, Canton, Ohio, is a seven-in-one appliance. It is a complete cleaning, spraying and sanitary system designed for the cleaning of rugs, cleaning and polishing of bare floors, cleaning of automobiles, spraying, deodorizing and mothproofing, and for use as a blower and as a hair drier. The "Sanitator" weighs 7¼ lb. Complete cleaning of the home can be done without the use of any attachments, as the swivel nozzle allows the cleaner to get under low furniture. The handle can be easily detached and the "Sanitator" converted into an automobile cleaner, deodorizer, blower, etc. The bag is so located that dirt falls directly into it, preventing back pressure on the motor. The bag does not interfere with the operation of the cleaner and moves with the handle in going under low objects.

"Anti-Short" Bushing

A bushing that slides in between the conductor and the steel armor, mechanically protecting the electric conductor from injury in the use of A.B.C. cable, is announced by the National Electric Products Corporation, Pittsburgh. The bushing is of red fiber and stands a voltage test of about 4,000.

The National Electric Products Corporation has also developed a new conductor called the A.B.C. No. 2163, which is so designed that the "anti-short" bushing shows through gaps at the end of the connector. Consequently, while all other types of connectors, of course, can be used on A.B.C. as well as braided cable, the new No. 2163 A.B.C. fills the additional requirements of centering the "anti-short" bushing.

While developing this new fitting, the National Electric Products Corporation

has made some other improvements that fill a long-felt need in that it has made the barrel longer and has designed what it calls an E Z clamp strap. This is one-half of the large unthreaded end that fastens the cable. It is split, hinged on one side, and there is a big screw on the other. In operation, the clamp part comes down uniformly and smoothly on the cable without twisting the steel out of shape or bearing on any one particular point, as in the case of the single screw, thus distorting the steel. This style of steel makes it impossible for cable to jump out from its position.

The National Electric Products Corporation uses bond nuts on this connector instead of lock nuts. Sharp bonding spurs dig into side of the box through the enamel, forming a metal bond.

Flexible Cable Eliminates Tools for Stripping

A new type BX armored bushed cable which is said to eliminate the use of tools for stripping is introduced by the General Electric Company.

The doubled armored construction of this new cable consists of a flexible steel armor and a kraft armor between steel and conductors. The kraft armor, which replaces the outer braid, requires no tools for removal. It may be done by one hand operation, requiring less than three seconds to complete, and it strips automatically to provide space for the "anti-short" bushing.

The insertion of the "anti-short" fiber bushing between the sharp edges of steel and the conductors increases the insulation at the most critical point of installation and is a safeguard against grounds and repairs.

Electrical Patents

Announced by U. S. Patent Office

(Issued March 26, 1929)

17,244 (reissue). METER STRUCTURE; P. MacGahan, Orange, N. J. App. filed Aug. 23, 1928.

1,706,410. TIME SWITCH; C. M. Peacock, Chicago, Ill. App. filed Oct. 2, 1926.

1,706,412. TERMINAL FOR CONDUCTORS; C. A. Roberts, Pittsburgh, Pa. App. filed Feb. 29, 1924.

1,706,443. CONTROLLER FOR ALTERNATING-CURRENT MOTORS; T. I. Dekle, Chicago, Ill. App. filed Oct. 17, 1925.

1,706,483. REVERSIBLE ELECTRICAL MOTOR; W. J. Corbett, Alhambra, Calif. App. filed Aug. 2, 1926.

1,706,488. INSULATOR; K. A. Hawley, Baltimore, Md. App. filed Sept. 22, 1925.

1,706,515. PORTABLE ELECTRIC HEATING DEVICE; L. R. Barber, Fresno, Calif. App. filed Aug. 25, 1924.

1,706,518. SWITCH; H. R. Blough, Deceased, Late of Johnstown, Pa. App. filed Feb. 15, 1928.

1,706,523. ELECTRICAL CONTROLLER; W. B. Churcher, Cleveland Heights, Ohio. App. filed Feb. 12, 1925.

1,706,524. METAL FABRIC AND METHOD OF MAKING THE SAME; V. R. Farr, Donora, Pa. App. filed Dec. 13, 1926.

1,706,529. APPARATUS FOR ELECTROGALVANIZING; P. Jepsen, Worcester, Mass. App. filed Feb. 9, 1927.

1,706,537. CASING FOR ELECTRIC METERS; R. Mercier, Paris, France. App. filed July 22, 1925.

1,706,570. RHEOSTAT; G. W. Elmwall, New York, N. Y. App. filed May 1, 1926.

1,706,574. ELECTRIC TRANSFORMER; J. B. Hodtum, Pittsburgh, Pa. App. filed March 15, 1927.

1,706,618. CURRENT COLLECTOR; E. A. Larsson, Mansfield, Ohio. App. filed Oct. 9, 1926.

1,706,627. ELECTRIC SWITCH; A. D. McGibbon, Plainville, Conn. App. filed March 23, 1928.

1,706,652 and 1,706,653. CURRENT COLLECTOR; H. P. Chandler, Mansfield, Ohio. App. filed Oct. 9, 1926.

1,706,701. ELECTRICAL INSTRUMENT; A. C. Loewer, Parkville, Md. App. filed Dec. 20, 1926.

1,706,705. SYSTEM OF DISTRIBUTION; M. E. Reagan, Pittsburgh, Pa. App. filed Oct. 5, 1923.

1,706,713. PERIODIC RECLOSING CIRCUIT INTERRUPTER; H. A. Travers, Forest Hills, Pa. App. filed Sept. 27, 1924.

1,706,735. VARIABLE AIR CONDENSER; L. L. Jones, Oradell, N. J. App. filed Sept. 10, 1925.

1,706,746. ELECTRIC SWITCH; C. W. Rice, Schenectady, N. Y. App. filed March 17, 1924.

1,706,782. ELECTRIC SWITCH; J. D. Hilliard, Schenectady, N. Y. App. filed March 17, 1924.

1,706,793. ELECTRIC SWITCH; W. Lindsay, Chicago, Ill. App. filed July 11, 1923.

1,706,798. SAFETY DEVICE FOR ELECTRICAL HEATING APPARATUS; P. McIlveney, Auckland, New Zealand. App. filed Jan. 18, 1927.

1,706,807. SYSTEM OF DISTRIBUTION; H. V. Nye, West Allis, Wis. App. filed April 17, 1922.

1,706,810. ELECTRIC APPARATUS; W. E. Paul, Schenectady, N. Y. App. filed Sept. 23, 1925.

1,706,811. COVER FOR CONDUIT-OUTLET BOXES; J. T. Pearson and R. H. Olley, Syracuse, N. Y. App. filed March 12, 1925.

1,706,816. ELECTRICAL CONDENSER AND PROCESS; G. W. Pickard, Newton Center, Mass. App. filed May 12, 1920.

1,706,818. DYNAMO-ELECTRIC MACHINE AND WINDING THEREFOR; W. H. Powell, Wauwatosa, Wis. App. filed Feb. 18, 1926.

1,706,834. ELECTRIC FLATIRON; D. Zorgo, Montreal, Quebec, Can. App. filed March 26, 1926.

1,706,842. WELDING MACHINE; G. E. Cooper, West Allis, Wis. App. filed June 7, 1924.

1,706,850. HUMIDITY-RESPONSIVE CIRCUIT-CLOSING DEVICE; F. C. Hingsburg, Baltimore, Md. App. filed Dec. 12, 1922.

1,706,869. ELEVATOR SIGNALING SYSTEM; F. A. Boedtcher, Bergenfield, N. J. App. filed Nov. 29, 1921.

1,706,879. HOUSE HEATER; J. S. Gullborg and C. S. Ongman, Chicago, Ill. App. filed Feb. 18, 1927.

1,706,880. METHOD OF BASING AND SOLDERING; D. S. Gustin, Bloomfield, N. J. App. filed Dec. 21, 1926.

1,706,882. MANUFACTURE OF ELECTRIC INCANDESCENT LAMPS AND THE LIKE; J. J. Higgins, East Orange, N. J. App. filed July 20, 1922.

1,706,890. THERMAL CONTROL DEVICE; A. J. Kusel, Bridgeport, Conn. App. filed March 17, 1927.

1,706,898. CORD GRIP FOR ELECTRICAL APPARATUS; C. W. D. Peel, Dartford, England. App. filed March 22, 1928.

1,706,900. SWITCH-CONTROLLED ELECTRICAL CONNECTER PLUG; L. Propp, New York, N. Y. App. filed June 3, 1927.

1,706,907. ELECTRODE HOLDER; M. Wells, Los Angeles, Calif. App. filed March 12, 1928.

1,706,908. ELECTRIC STOVE; E. F. Westman, Tonka Bay, Minn. App. filed Sept. 30, 1927.

1,706,937. PROTECTIVE DEVICE FOR ELECTRIC SYSTEMS; E. C. Parham, Brooklyn, N. Y. App. filed Sept. 22, 1924.

1,706,939. EVAPORATOR; S. Rosenthal, Hamburg, Germany. App. filed May 5, 1927.

1,706,950. ELECTROLYTIC RECTIFIER; G. D. Bagley, Great Neck, and F. T. Bowditch, Elmhurst, N. Y. App. filed June 28, 1924.

1,706,951. ELECTROLYTIC APPARATUS; R. C. Benner, Bayside, N. Y. App. filed June 28, 1924.

1,706,968. APPARATUS FOR THE CONTROL OF A MOVABLE MEMBER; M. Schleicher, Berlin-Charlottenburg, and Hans Poleck, Berlin-Lichterfelde, Germany. App. filed Sept. 29, 1926.

1,706,973. CONNECTOR FOR HOLLOW ELECTRICAL CONDUCTORS OR TUBES; J. Zagorski, Frankfort-On-The-Main, Germany. App. filed June 1, 1927.

1,706,987. ELECTRIC-WIRE INSULATOR; O. Schaffler, Detroit, Mich. App. filed July 18, 1927.

1,706,989. OPERATING MECHANISM FOR FARE REGISTERS; E. H. Thompson, Evanston, Ill. App. filed Feb. 21, 1925.

1,706,992. BONDING PIN; L. H. Ayer, Chicago, Ill. App. filed Feb. 26, 1923.

1,706,997. VALVE HEATER; A. H. Davis, Jr., Buffalo, N. Y. App. filed Nov. 10, 1925.

1,707,004. ARC-LAMP APPARATUS; N. E. Goodrich, Battle Creek, Mich. App. filed Aug. 1, 1927.

1,707,009. TRANSFORMER-CORE STRUCTURE; W. F. Hendry, Ossining, N. Y. App. filed June 22, 1927.

1,707,016. SWITCH HEATER; E. B. Keim, Philadelphia, Pa. App. filed Sept. 13, 1928.

1,707,023. TRANSFORMER; E. N. Rauland, River Forest, Ill. App. filed March 11, 1926.

1,707,036. PROCESS OF ARC WELDING; M. Zack, Cologne-On-The-Rhine, Germany. App. filed Oct. 28, 1927.

1,707,042. AUTOMATIC ELECTRIC FLATIRON; M. C. Bersted, San Diego, Calif. App. filed Feb. 14, 1927.

1,707,054. INSULATOR; O. Doelter, Monterey, Calif. App. filed March 17, 1926.

1,707,070. LIQUID RHEOSTAT; E. S. Acheson, Richmond Heights, Mo. App. filed April 26, 1926.

1,707,079. SYSTEM FOR MEASURING ELECTRICAL QUANTITIES; R. Dubusc, Paris, France. App. filed May 12, 1927.

1,707,126. MULTIPLE SWITCH; J. J. Loher, Chicago, Ill. App. filed Feb. 23, 1926.

1,707,147. RESISTANCE RHEOSTAT; H. G. Smith, Marshall, Texas. App. filed Sept. 10, 1926.

1,707,150. INSULATION OF CONTACT RAILS OF ELECTRIC RAILWAYS; G. Swallow, Bridgeport, Pa. App. filed March 30, 1926.

1,707,170. GAS-SAVING ATTACHMENT; G. P. Miller, Dover-Foxcroft, Me. App. filed Aug. 1, 1927.

1,707,185. DEVICE FOR CONTROLLING ELECTRIC CIRCUITS; A. W. Burke, Pelham Manor. N. Y. App. filed Jan. 19, 1926.

New Trade Literature

INSULATORS. — The Locke Insulator Corporation, Baltimore, Md., is distributing a booklet covering the Locke multi-part pin type insulators.

ELECTRIC WATER HEATER.—Catalog E issued by the McGraw Electric Company, Omaha, Neb., describes the special features of the "Clark" electric water heater and accessories and contains illustrations showing typical installations of the heater for various purposes. The company also is distributing a net price sheet for central stations.

SWITCHES AND SWITCH PLATES.—The Arrow Electric Division of the Arrow-Hart & Hegeman Electric Company, Hartford, Conn., is distributing a series of new price sheets covering its switches and switch plates.

PORTABLE POWER UNIT. — A pamphlet issued by the Century Electric Company, 1806 Pine Street, St. Louis, describes and illustrates the Century portable power unit developed especially for farm applications.

EMERGENCY LIGHTING EQUIPMENT.—The Usem Company, 515 West 29th Street, New York City, is distributing bulletin No. 200 which describes and illustrates the "Surelite" emergency light and power system.

ELECTRICITY.—"Building in the Electrical Age" is the title of circular No. 1826 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The publication is well illustrated with pictures of many of the leading buildings in the country, together with views of Westinghouse equipment installed in these buildings. The installation views that are given cover every phase of electrification for the successful operation of buildings, including penthouse views of elevator apparatus, switchboards, panelboards, interior lighting, commercial cooking and many others necessary for various types of structures.

LIGHTNING ARRESTERS.—"Discharge Rate of Lightning Arresters" is the title of booklet No. 265, the third of a series covering the technical features of the crystal valve lightning arrester as they apply to modern lightning protection, which is being issued by the Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia.

PLUGS, RECEPTACLES AND FIXTURES. — The Crouse-Hinds Company, Syracuse, N. Y., has issued bulletin No. 2121, which describes and illustrates its "Arktite" circuit-breaking plugs and receptacles. The company also is distributing bulletin No. 2129, covering its vaporproof industrial fixtures V series, with reflector.

TRANSFORMERS, LIGHTNING ARRESTERS, ETC. — The General Electric Comany, Schenectady, N. Y., is distributing the following bulletins: GEA-863A describing and illustrating its type IL "Novalux" series transformers, GEA-1087 covering its type RV "Novalux" constant-current transformers, GEA-93D describing its line-type lightning arresters, GEA-98A covering its type BSR adjustable varying speed motors, GEA-1101 covering induction motor-generator sets for motion-picture projection, GEA-1102 describing the G-E electric heating equipment for hot galvanizing tanks, GEA-961A covering its helicoil (sheathwire) resistor units for cable-reel motors and GEA-1097 describing the straight series or multiple types G-E "Novalux" highway units with Holophane B-symmetric rippled bowl diffuser.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Johannesburg, South Africa (No. 37,612), for barbers' electrical appliances.

Purchase is desired in São Paulo, Brazil (No. 37,493), of electric furnaces.

Purchase and agency are desired in Glasgow, Scotland (No. 37,495), for household electrical appliances.

Purchase and agency are desired in Nyeri, British East Africa (No. 37,632), for household electrical appliances.

An agency is desired in Vancouver, Canada (No. 37,498), for lighting fixture parts.

Purchase and agency are desired in Rosario, Argentina (No. 37,492), for farm lighting sets.

Purchase and agency are desired in Barcelona, Spain (No. 37,496), for single phase motors and wiring supplies, except wire.

Purchase is desired in Milan, Italy (No. 37,592), of electric phonographs, talking motion-picture apparatus and television apparatus.

Purchase and agency are desired in Hamburg, Germany (No. 37,629), for electric portable tools.